**STAFF REPORT 08-14-2019 REGULAR MEETING** **PREPARED BY:** A. PHILLIPS
**APPLICATION NUMBER:** 19-6371
**ADDRESS:** 2444 SEMINOLE STREET
**HISTORIC DISTRICT:** INDIAN VILLAGE
**APPLICANT:** EMMALYN HELGE
**STAFF SITE VISIT:** 08-02-2019

## PROPOSAL

The building located at 2444 Seminole Street is a 2½-story single-family residence constructed in 1913. The structure is clad in painted brick at the first floor and stucco at the second floor and features carved wood details. The side-gabled roof is covered in dark brown asphalt shingles and includes a small dormer facing the street and centered within the symmetrical front elevation, above the covered entry porch.

With the current proposal, the applicant is seeking the Commission's approval **to remove the existing light tan paint from all brick and repaint with faux brick paint scheme per the attached application**. Included in the proposal are the following scope items:

- Brick repair and repointing as needed to match existing
- Remove existing paint from all brick including pre-washing, scraping, and wire-brushing loose material to prep for painting
- Paint all brick with dark brown and red paint colors B:18, B:8, and A:9 from associated Color System D with faux-finish painting method to return the brick and mortar to its original appearance.

## STAFF OBSERVATIONS

- The application states, "On the 'Color System D' Guide it states that if the brick has been painted '*the paint*

*should be removed or repainted in dark red or dark brown to match the original brick color.*" While this is a true statement, please note that the Color System D guide is referencing painted brick within half-timbering (see highlighted portion of Color System D attached).

- It is unknown as to whether or not the brick was originally painted. The designation slides appear to show unpainted brick, however, building permit records show the building was painted in 1975 and 1984.
- Staff is concerned about the proposed paint-removal method. Scraping and wire-brushing is considered to be abrasive and should not be used on historic masonry. In general, all cleaning work to be performed on historic masonry should be done using the gentlest means possible (See National Park Services Preservation Briefs and excepts from the Secretary of the Interior's Standards Illustrated Recommendations for Rehabilitation).

**ELEMENTS OF DESIGN**

***(1) Height.*** Virtually all of the houses in the district have two (2) full stories plus attic or finished third floor within the roof; these are generally called "two-and-a-half" story houses. Additions to existing buildings shall be related to the existing structure; new buildings shall meet the following standards:

(i) The eight (8) adjoining houses on the same face, excluding any houses built since 1930, churches, schools and commercial structures, shall be used to determine an average height. If eight (8) houses are not available on the same block face, then one or more houses as close as possible to being directly across the street from the proposed structure may be used. On Jefferson Avenue, the five (5) existing houses shall be used. The height of the two (2) adjoining houses shall be added into the total twice, with a divisor of ten (10) (seven (7) on Jefferson Avenue) used to determine the average. Any new building must have a height of the main roof of at least eighty (80) per cent of the resulting average; in no case shall a new building be taller than the tallest roof height included in the computation. In determining the height of existing structures and proposed structures, the highest point of the main roof shall be used, even where towers, cupolas, or other minor elements may be higher.

(ii) The level of the eaves of a proposed new structure having as much or more significance for compatibility as the room height, an average eave or cornice height shall be determined by the same process as that described above. The proposed new structure shall have a height at the eaves, or cornice, of not less than ninety (90) per cent of the average determined from existing structures, and in no case shall the eaves or cornice of the proposed structure be lower than the lowest eave or cornice height used in the computation, nor higher than the highest.

***(2) Proportion of buildings' front facades.*** Proportion varies in the district, depending on age, style, and location in a specific subdivision. Height being established by the standards above, proportion will be established by permitting no proposed building or addition to create a front facade wider or narrower than those existing on the same block.

***(3) Proportion of openings within the facade.*** Window openings are virtually always taller than wide; several windows are sometimes grouped into a combination wider than tall. Window openings are always subdivided, the most common window type being guillotine sash, whose area are generally further subdivided by muntins. Facades have approximately fifteen (15) per cent to thirty-five (35) per cent of their area glazed: Sunporches with a very high proportion of glass subdivided by mullions and muntins are common.

***(4) Rhythm of solids to voids in front facades.*** In buildings derived from classical precedents, voids are usually arranged in a symmetrical and evenly-spaced manner within the facade. In examples of other styles, especially those of neo-Tudor and Victorian substyles, voids are arranged with more freedom, but usually is a balanced composition.

***(5) Rhythm of spacing of buildings on streets.*** The spacing of the buildings is generally determined by the setback from the side lot lines; these tend to be consistent, even though lot width may vary. Because of the existence of several subdivisions and their related subdivision and deed restrictions, the placement of buildings on lots varies from area to area in the district. In the case of very wide properties, two (2) conditions exist. A very wide site may have a house placed centrally upon it, with extensive side yard space; this occurs only with extremely large houses by district standards. A more typical placement of houses of avenge size for the district is at the side of the wide site, placed normally in relation to one of the adjoining houses. The rest of the property is a side yard on the other side of the house, and the entrance is often oriented toward that side yard.

***(6) Rhythm of entrance and/or porch projections.*** In those examples of classical inspiration, entrances and porches, if any, tend to be centered on the front facade. Other examples display more freedom with entrance and porch placement, with some having the main entrance at the side. Porches, often permanently enclosed sun porches, are often placed at the side of the building.

***(7) Relationship of materials.*** The majority of the buildings are faced with brick, while many are partially or totally

stucco. There are some stone buildings; clapboard is rare, and almost never the sole material. Wood shingle is occasionally used as a wall covering, usually at the second floor level, and never as the sole material. Roofing includes slate, tile, and wooden and asphalt shingles. Stone trim is common. Wood is almost universally used for window frames and other functional trim, and is used in many examples for all trim. Because of the existence of several subdivisions and their related deed restrictions, the exterior textures and materials may vary from block to block in the district.

***(8) Relationship of textures.*** The most common relationship of textures in the district is that of the low-relief pattern of mortar joints in brick contrasted to the smooth surface of wood or stone trim. The use of stucco or concrete, with or without half-timbering, as a contrast to brick surfaces is not unusual. Tile, slate, or wood shingle roofs have particular textural values where they exist. Asphalt shingles, generally, have little textural interest, even in those types which purport to imitate some other variety.

***(9) Relationship of colors.*** Natural brick colors (red, yellow, brown, buff) predominate in wall surfaces. Natural stone colors also exist. Where stucco or concrete exists, it is usually left in its natural state, or painted in a shade of cream. Roofs are in natural colors (tile and slate colors, wood colors) and asphalt shingles are predominantly within this same dark color range. Paint colors often relate to style. The classically inspired buildings, particularly neo-Georgian, generally have woodwork painted white, cream or in the range of those colors, including "putty." Doors and shutters are frequently dark green or black. Colors known to have been in use on buildings of this type in the eighteenth or early nineteenth centuries on similar buildings may be considered for suitability. Buildings of Medieval inspiration (notably neo-Tudor) generally have painted woodwork and window frames of dark brown or cream color. Half-timbering is almost always stained dark brown. Queen Anne or late Victorian examples may have several paint colors on a single facade. These tend to be dark in tone and frequently of the "earth tone" family. The original colors of any house, as determined by professional analysis, are always acceptable for that house, and may provide suggestions for similar houses.

***(10) Relationship of architectural details.*** These generally relate to style. Neo-Georgian buildings display classic details, mostly in wood, and sometime in stone. Areas commonly, but not always, treated are porches, shutters, window frames, cornices, and dormer windows. Details on Mediterranean style or vernacular buildings are often done in stone, brick, tile, and sometimes in stucco. They include arched windows, door openings, and porches. Buildings of medieval inspiration tend to have details in the form of carved wood or carved stone ornament on window frames, door frames, and eaves. Queen Anne or late Victorian style buildings tend to have details in wood, stone, or molded brick commonly embellishing cornices, window frames and door frames. In general, the various styles are rich in architectural details.

***(11) Relationship of roof shapes***. Roofs with triangular gables and hip roofs predominate. A few examples of the gambrel-type roof exist. Complex arrangements of the gabled and/or hip types, with subsidiary roofs, are not unusual. Dormers are common. Flat roofs exist primarily on porches and sunrooms, and other minor elements; large hip roofs sometimes have relatively small flat sections in the center.

***(12) Walls of continuity.*** The major wall of continuity is created by the buildings, with their uniform setbacks within the blocks. New buildings should contribute to this wall of continuity. Where gaslights are sufficiently numerous, and where trees in rows have survived in sufficient numbers, minor walls of continuity are created. Fences across side lots contribute to the major wall of continuity where placed at the front yard setback line.

***(13) Relationship of significant landscape features and surface treatment.*** The typical treatment of individual properties is a flat front lawn area in grass turf, often subdivided by a walk leading to the front entrance, and sometimes with a walk at the side leading to the rear. Materials for such walks are concrete, brick, or stone, or combinations of those materials. Some front yards have rectangular raised earthwork terraces upon which the house stands. These unpaved terraces have sloping embankments or brick and/or stone retaining walls at the change of grade. Foundation plantings, often of a deciduous character, characteristic of the period 1895—1930, are present virtually without exception. Hedges between properties, and ornamental front yard fences or hedges are not uncommon. The American elm is virtually extinct in the district, though once the dominant tree. Replacement trees should be characteristic of the area and period, though only a disease-resistant American elm would be a practical choice. Plantings of new trees should be directed toward the restoration of the former straight-line rows of large trees on the front yards and "tree lawns." Straight side driveways leading from the street to rear garages exist, but alley-facing garages are common, particularly in the southern portion of the district. Where alley-facing garages are common, the lack of driveways lends a unity to the succession of front lawns. Driveway materials include concrete, brick and gravel. Side lots are not uncommon in the district, and a number of these form a part of the original site plan for the residence. Such side lots are usually landscaped, often fenced at or near the setback line, and very occasionally contain paved areas such as a tennis court. The street right-of-way of eighty (80) feet combined with a pavement width of between twenty-four (24) and twenty-nine (29) feet creates wide "tree lawns" or berm areas, which adds to the generous ambience of the urban landscape of

the district. Street pavements are now asphalt; cut stone curbs still exist in portions of the district. Alleys are frequently paved with brick, particularly where alley-facing garages are common. Fencing ranges widely in type; fencing in public view was generally designed to compliment the style, design material, and date of the residence.

***(14) Relationship of open space to structures.*** Open space in the district occurs in the form of vacant land, a city park, school yards for the Waldorf and Nichols Schools, and side lots. Where an original or early arrangement of a house and grounds included and still includes landscaped lots which form part of the landscaping plan for the residence, such landscaped lots are significant landscape features.

***(15) Scale of facades and facade elements.*** There is a variety in scale from block to block and style to style; most houses have a large and substantial appearance. The size and complexity of facade elements and details either accentuate or subdue the scale of the facades. Facade elements have been determined by what is appropriate for the style. Large wings at the front are atypical, while small wings at the side, usually in the form of sunrooms and sunporches, are common. Window sash are usually subdivided by muntins, which affects the apparent scale of the windows within the facades.

***(16) Directional expression of front elevations***. In general, the expression of direction is neutral.

***(17) Rhythm of building setbacks***. Because of the existence of various subdivisions and their related subdivision and deed restrictions, setbacks vary from area to area within the district, though they are consistent within each block or area. The varying designs of the houses, occasionally with slight setbacks in the facades, cause the houses to relate to the front setback line in different ways; this creates a slight variation in the setback line. Nevertheless, within each block or area a wall of continuity is created.

***(18) Relationship of lot coverage***. Lot coverage ranges from fifty (50) per cent to twelve 912) per cent or less in the case of homes with large yards. Most homes are in the twenty (20) per cent to thirty (30) per cent range of lot coverage.

***(19) Degree of complexity within the facade.*** The degree of complexity has been determined by what is typical and appropriate for a given style. The classically inspired buildings usually have simple, rectangular facades with varying amounts of ornamentation. Other styles, such as "Queen Anne" and those of Medieval inspiration, frequently have facades complicated by gables, bays, slight setbacks, porches, and occasionally, turrets.

***(20) Orientation, vistas, overviews.*** While most of the buildings are oriented toward the street, it is not unusual for an entrance to face the side, especially in the case of a landscaped side lot or corner house. The street facade in these cases is well coordinated with the rest of the street facades. Garages are frequently oriented either toward an alley or a side street; almost all garages are detached and at the rear of the lot. In those few cases where pre-1930 houses have attached garages, they are at the rear and are entered from the side or rear. The doors of such attached garages are generally not visible from the street.

***(21) Symmetric or asymmetric appearance.*** Neo-Georgian and other classically inspired buildings are generally symmetrical. Other styles, including the neo-Tudor, are generally asymmetrical, but balanced compositions.

***(22) General environmental character.*** The Indian Village District, with its long, straight streets, its hierarchy of walls of continuity (lamps, trees, buildings) and its large, dignified homes, has an urban, substantial, low density residential character.

## RECOMMENDATION

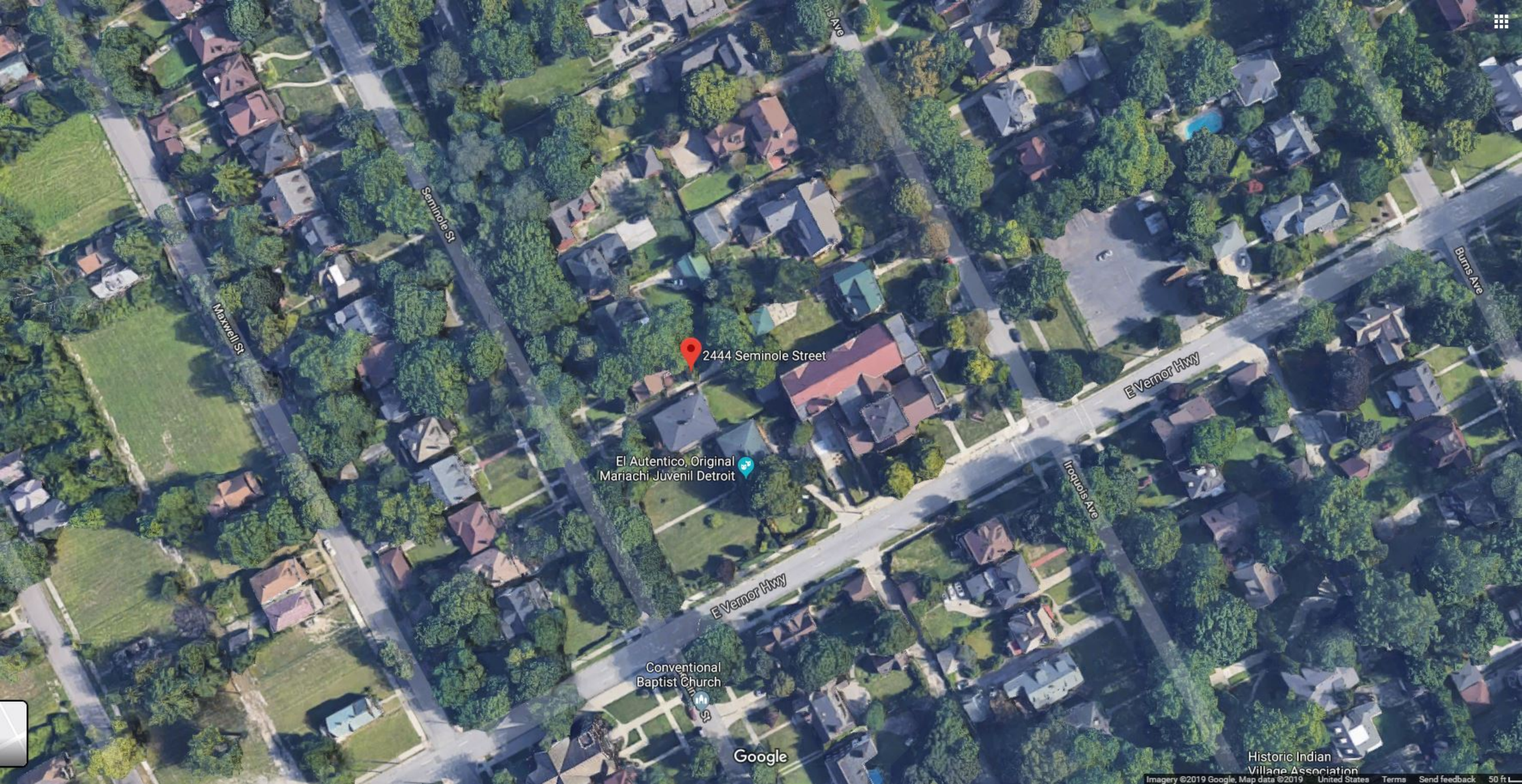
It is staff's opinion that the work, as proposed, has the potential to destroy historic materials. Staff therefore recommends that the Commission find removal of the existing paint on the brick to be inappropriate as the scope of work does not meet the Secretary of the Interior's Standards for Rehabilitation

- *7) Chemical or physical treatments, such as sandblasting, that cause damage to historic materials shall not be used. The surface cleaning of structures, if appropriate, shall be undertaken using the gentlest means possible.*

- *9) New additions, exterior alterations, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment.*

Regarding the scope of work related to repainting the existing painted brick with a faux-brick paint, staff is withholding a recommendation as staff has never seen the faux-brick painting treatment proposed or executed in the field. Staff is also withholding a recommendation due to the lack of certainty as to whether or not the brick was originally painted. If the building was originally painted, it should remain painted. If the building was originally unpainted, it may be able to return to its unpainted finish depending on the condition of the original brick surface. If

the face surface of the brick is damaged and the interior material of the brick exposed, the brick is vulnerable to moisture penetration and deterioration. If the face surface of the brick is intact and solid and the applicant is choosing to remove the existing paint, the paint should be removed using the gentlest means possible to prevent the compromise of the weather-proof surface of the brick.


2444 Seminole Street
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Burns Ave
El Autentico, Original Mariachi Juvenil Detroit
Conventional Baptist Church
Google
Historic Indian Village Association
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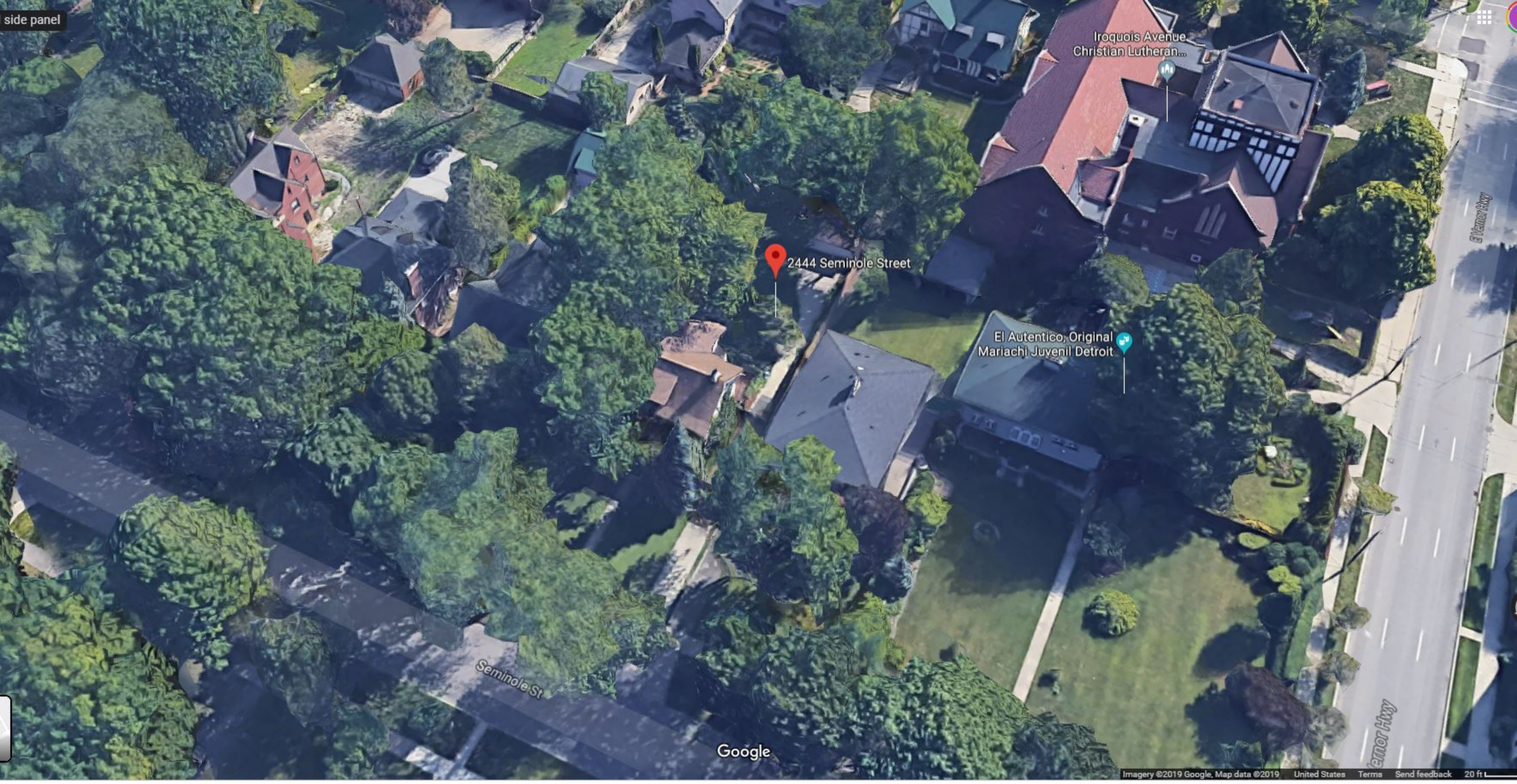
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STAFF SITE VISIT 08/02/2019


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REPORT

# ❖ 2444 Seminole Brick Restoration Proposal ❖

Dear Historic District Commissioners,

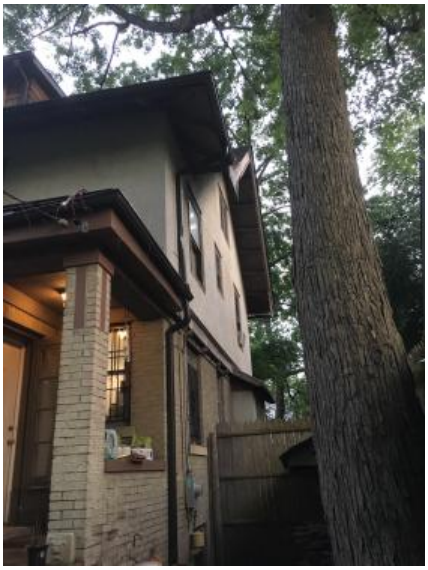
Thank you for considering our proposal to restore our painted brick to its original colors. As you can see in the photos below, the brick was painted light grey-beige by previous home owners. We are hoping to remedy that mistake. The bottom half of our home and chimney is brick, while the top half is stucco. (Our stucco and trim historic paint colors have already been approved and are being completed now.)

On the 'Color System D' Guide it states that if the brick has been painted *"the paint should be removed or repainted in dark red or dark brown to match the original brick color."* That is our intention. We will match the dark brown and red paint colors B:18, B:8, and A:9 in the brick restoration.

If our request is not approved, we will keep the existing brick as it is and make no change.

Thank you for your consideration,
Emmalyn Helge & Kyle Langvardt

## ◆ Current House Photos ◆



# ❖ 2444 Seminole Brick Restoration Proposal Page 2 ❖

The Brick Painters.com
"Faux Finish Restoration Painting"

Toll Free: 1-877-653-4469
Email: info@thebrickpainters.com

## ◆Our Contractor: The Brick Painters.com Ltd.◆

We have done hours of research, phone calls, and on-site estimates before choosing The Brick Painters as our contractor. They are located in Port Hope, Ontario, which is just east of Toronto.

**From their website:** Restore your building to its original, historic, "Unpainted Appearance". The Brick Painters can do it at a fraction of the cost of paint stripping or sand blasting. You will avoid unleashing lead paint and chemicals from existing paint and avoid EPA approvals.

TheBrickPainters.com has developed a proprietary faux-finish painting technique. We re-paint previously painted brick and mortar to achieve the natural and authentic appearance of unpainted brick and mortar.

The Brick Painters.Com has developed a patented faux-finish technique that leaves an original appearance that even under the closest scrutiny is virtually undetectable. No two bricks are alike. Each brick and the mortar will have a natural, variable range of color throughout.

TheBrickPainter.com offers all the services you need for restoring your brickwork back to its original unpainted appearance.

- Commercial, industrial, and residential brick painting
- Free job quote
- Limited 10 year warranty on all labour and materials
- Quality work from our award winning team painting team
- Full range brick staining service, for masonry that has never been painted. Great for matching additions, areas of tuck pointing, bricked in window areas that don't match, etc.
- Patch deteriorating masonry
- Vandalized wall restoration / graffiti cover up
- Wide range of faux finish colour options
- Touch up on arches & decorative brick work
- Stone sill re-painting
- Wall preparation (For example: Wire brushing or scraping of loose material, pre-washing, impediment removal, etc.)
- Brick repair or re-pointing that may be necessary prior to painting
- Large wall painting – we have access to ladders, scaffolding or lift equipment if necessary

# ❖ 2444 Seminole Brick Restoration Proposal Page 3 ❖

## ◆Scope of Work◆

- (If Needed) Brick Repair and Tuck Pointing:
  Cutout loose mortar joints with diamond tip circular saw blade to a depth of 1/2" or more as needed, remove all adherent dirt and grime and so as to receive the tuckpointing of the new mortar, and pressure point areas with type O mortar, matching as close as possible in terms of the size, texture and mortar of existing color of present mortar joints.

- Wall Preparation: Pre-washing, scraping, wire brushing loose material to prep for painting

- Paint bricks on lower portion of house, all sides, to restore original appearance

- Bricks painted with dark brown and red paint colors B:18, B:8, and A:9 from Historic Commission Color System D with faux-finish painting method developed by The Brick Painters.com

- Mortar to be the same grey stone color as the stone elements under windows and in columns

## ◆Before and After Photos from The Brick Painters Ltd.◆

REPORT

# BEFORE & AFTER



That's
PAINT!


REPORT
DESIGNATION SLIDE 1971

REPORT

DESIGNATION SLIDE 1980

REPORT AP-2 (Rev. 9-78)

2

# City of Detroit

**BUILDINGS AND SAFETY ENGINEERING DEPARTM**
4th Floor City-County Building
Telephone: 224-3235

NEWPORT BROWN
OLD PLANTATION
DITIO
ERATIO
MENTS
GE OF
ANCY
FOUNDATIONS
REPAIRS
USE OF LAND

## APPLICATION FOR BUILDING PERMIT

APPLICANT SHALL FILL IN ALL BLANKS PERTINENT TO BUILDINGS AND PREMISES
Separate applications and two sets of plans are required for each building or structure. Such plans shall include lot plots. Applications must be TYPEWRITTEN or PRINTED IN INK.

5/23/84
DATE

**FOR ADDITIONS, ALTERATIONS OR REPAIRS** (Exterior or Interior)

Describe in Detail PAINTING EXTERIOR OF HOME, SCRAPING OR BURNING OFF EXISTING PAINT WHERE NECESSARY, TUCK POINTING OF EXISTING BRICK WHERE MORTAR IS MISSING - CURRENT PAINT FLAKING BADLY. TRIM TO BE PAINTED "NEWPORT BROWN". BRICK AND STUCCO TO BE PAINTED ~~"PLYMOUTH ROCK"~~. EXISTING BRICK PAINTED ~~In addition, please state use~~ ALSO WHITE PAINT DRIPPED ON BRICK WHEN HOUSE WAS PAINTED 10 YEARS AGO BY PREVIOUS OWNER

SIZE _____ ft. WIDE by _____ ft. LONG by _____ ft. HIGH 2'/2 Stories

Will the proposed building or structure encroach upon any easement, alley or public property? NO

Estimated cost of additions, alterations or repairs $ 8,000.00

~~**FOR CHANGE OF OCCUPANCY:**~~

~~Portion of Building Involved~~ BRICK - PLYMOUTH ROCK
STUCCO - OLD PLANTATION

~~Proposed Use of Portion Involved~~ _____

**USE OF LAND** (Fill in this section only when securing a permit for the use of vacant land)

Existing or previous occupancy of premises _____

Are there any existing buildings or structures on this parcel? _____

Present use of such buildings or structures _____

Proposed use of such buildings or structures _____

Proposed occupancy of premises _____

Are toilet facilities available _____

ENCLOSURES: (Fences, etc.) _____

**COOLING TOWERS, PONDS, ETC.:** (For air conditioners or other refrigeration equipment)
(Two lot plots and structural plans and three mechanical plans required)

Is unit water cooled? _____ Total weight of unit _____

Is unit air cooled? _____ Total weight of unit _____

Tonnage or horsepower rating of cooling tower _____

Size and number of existing refrigerating units this tower will serve _____

Size and number of new refrigerating units this tower will serve _____

Total number of refrigerating units this tower will serve _____

REPORT

**PLEASE FILL IN ALL ITEMS ON THIS PAGE**

Location, ownership and details must be CORRECT, COMPLETE and LEGIBLE.

**APPLICANT, CONTRACTOR OR BUILDER** RUSSELL INTERIORS INC.

Address 18140 TOEPFER ROAD EAST DETROIT MICH. 48021
(Number) (Street) (City and Zip Code)

Phone No. 3137741130 Federal ID or Social Security No.
(Area Code)

Residential
State License No.

**OWNER OF RECORD** Scott R. McDUFFEE

Address 2444 SEMINOLE DETROIT MICHIGAN 48214
(Number) (Street) (City and Zip Code)

Phone No. 313 922 7779 Federal ID or Social Security No. 386-44-7921
(Area Code)

**LOCATION:** Side of Street EAST ( 2444 ) SEMINOLE St.
North, East, South, West House Number

Between VERNOR St. and CHARLEVOIX St.
(Cross Street) (Cross Street)

Lot Number Subdivision

Corner

LOT SIZE: ft. WIDE by ft. DEEP Interior Alley Width
Rear or Side

*DEED or OTHER EVIDENCE OF OWNERSHIP must be presented before a building permit will be issued.*

**EXISTING BUILDING:** (Involved in Change of Occupancy, Alteration, Repair or Addition)

GENERAL TYPE BRICK - STUCCO WOOD TRIM Exterior Walls
Frame, Veneer, Brick, Cement Block, etc.

WOOD
Floor Construction Roof Construction

SIZE ft. WIDE by ft. LONG by ft. HIGH Stories

PRESENT USE of Entire Building RESIDENTIAL

" " Basement or Cellar

" " First Floor

" " Second Floor

" " Third Floor

" " Other Floors

Are there any other buildings on lot? GARAGE Use AUTO'S

Will flammable liquids or substances be used or stored on the premises?

Is any portion of building used for shipping or receiving room into which motor vehicles are driven?

Will approved garbage grinding equipment be installed? incinerating equipment?

If commercial or industrial occupancy, state number of employees. Male Female

REPORT

# COLOR SYSTEM D

**ASSOCIATED ARCHITECTURAL STYLES:** (13) ENGLISH REVIVAL

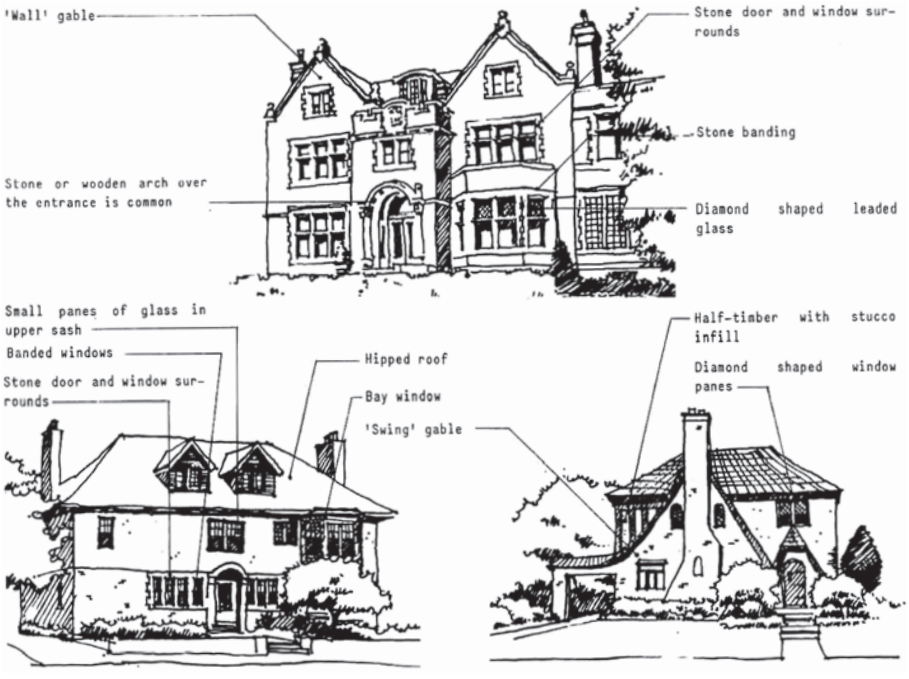
Detroit is particularly rich in examples of the Tudor, Gothic, and English Cottage Styles erected after the turn of the century. Usually of stone, brick, and heavy timber construction, these houses were often influenced by the Arts and Crafts Movement which stressed the use of such natural materials. As a consequence, the colors used on these houses should reflect this concern for nature and an understanding of the original English prototypes on which the styles were based.

A particular problem is encountered with the half-timbering that is so typical of these styles. In the original medieval buildings, these exposed timbers were the structural supports of the frame and roof with spaces between filled with lime plaster or rough cast sand stucco, stone, or brick. With this in mind, these heavy frames should be painted to look like weathered English oak; black, dark brown, or, perhaps, dark green, or olive. When the infill is brick, that area is not a problem unless it has been painted, in which case the paint should be removed or repainted in dark red or dark brown to match the original brick color. If, however, the infill between the framing is stucco, it should be painted white, as so many English originals are, to suggest the lime rich plastering which is naturally white or one of the river sand stuccoes which are more nearly yellow or cream when left in their natural state. On rare occasions when the sand used was of a reddish cast, the stucco assumed a faint rose beige.

Normally, the window and door frames and the projecting cornices will be painted the color selected for the heavy timber frames or a gray, brown or greenish stone color to match the actual stone trim of the house if such exists, or, a dark color such as black, dark brown, or dark green to suggest the metal casement windows which were normally iron and lead set in oak, frames which, like the heavy framing, darkened with age.

The trim of such houses rarely looks well done in a color lighter than the stone trim and certainly not in light reds, blues, yellows or greens. Occasionally, these houses were trimmed in white, but this generally provides too great a contrast to the usual brick and stone construction; as a consequence it is not recommended.

The more self-consciously Art and Crafts houses will hew closely to the guidelines set down above, stressing the darker browns, reds and greens and a concern for stucco that is natural in color and lighter than the dark framing of heavy wood and stone.



REPORT

# COLOR SYSTEM D

## ACCEPTABLE COLOR COMBINATIONS *MS = MUNSELL STANDARD

| BODY | TRIM | SASH | SHUTTERS |
|---|---|---|---|
| Stucco:<br>Leave natural or match original stucco color, or A:3, A:4, C:4, C:5, D:1, D:2 | Match half-timbering color or match existing stone trim color or match shingle color or A:8, A:9, B:6, B:8, B:11, B:12, B:13, B:14, B:18 | Match trim color or A:9, B:18, B:19 | Match trim color or match sash color |
| Half-timbering:<br>A:8, B:6, B:8, B:11, B:12, B:13, B:14, B:19 | | | |
| Shingles/Clapboard:<br>B:6, B:8, B:11 (rare), B:12, B:13, B:14 | | | |
| Existing brick or stone | | | |

**A:3 Light Yellow**
**MS:** 5Y 8/6

**A:4 Pale Yellow**
**MS:** 2.5Y 8.5/4

**A:8 Blackish Green**
**MS:** 2.5BG 2/2

**A:9 Moderate Reddish Brown**
**MS:** 7.5R 3/6

**B:6 Moderate Brown**
**MS:** 7.5YR 4/4

**B:8 Grayish Brown**
**MS:** 5YR 3/2

**B:11 Grayish Olive Green**
**MS:** 5GY 4/2

**B:12 Grayish Green**
**MS:** 10G 4/2

**B:13 Moderate Olive Brown**
**MS:** 2.5Y 4/4

**B:14 Dark Grayish Olive**
**MS:** 10Y 2/2

**B:18 Dark Reddish Brown**
**MS:** 2.5YR 2/4

**B:19 Black**
**MS:** N 0.5/

**C:4 Yellowish White**
**MS:** 5Y 9/1

**C:5 Yellowish White**
**MS:** 2.5Y 9/2

**D:1 Brownish Pink**
**MS:** 7.5YR 7/2

**D:2 Light Brown**
**MS:** 5YR 6/4

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## STANDARDS FOR REHABILITATION & GUIDELINES FOR REHABILITATING HISTORIC BUILDINGS

# Rehabilitation

*Rehabilitation is defined as the act or process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features which convey its historical, cultural, or architectural values.*

## Standards for Rehabilitation

1. A property will be used as it was historically or be given a new use that requires minimal change to its distinctive materials, features, spaces and spatial relationships.
2. The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features, spaces and spatial relationships that characterize a property will be avoided.
3. Each property will be recognized as a physical record of its time, place and use. Changes that create a false sense of historical development, such as adding conjectural features or elements from other historic properties, will not be undertaken.
4. Changes to a property that have acquired historic significance in their own right will be retained and preserved.
5. Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize a property will be preserved.
6. Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture and, where possible, materials. Replacement of missing features will be substantiated by documentary and physical evidence.
7. Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.
8. Archeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.
9. New additions, exterior alterations, or related new construction will not destroy historic materials, features, and spatial relationships that characterize the property. The new work will be differentiated from the old and will be compatible with the historic materials, features, size, scale and proportion, and massing to protect the integrity of the property and its environment.
10. New additions and adjacent or related new construction will be undertaken in such a manner that, if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

# GUIDELINES FOR REHABILITATING HISTORIC BUILDINGS

## INTRODUCTION

In **Rehabilitation,** historic building materials and character-defining features are protected and maintained as they are in the treatment Preservation. However, greater latitude is given in the **Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings** to replace extensively deteriorated, damaged, or missing features using either the same material or compatible substitute materials. Of the four treatments, only **Rehabilitation** allows alterations and the construction of a new addition, if necessary for a continuing or new use for the historic building.

### Identify, Retain, and Preserve Historic Materials and Features

The guidance for the treatment **Rehabilitation** begins with recommendations to identify the form and detailing of those architectural materials and features that are important in defining the building's historic character and which must be retained to preserve that character. Therefore, guidance on ***identifying, retaining, and preserving*** character-defining features is always given first.

### Protect and Maintain Historic Materials and Features

After identifying those materials and features that are important and must be retained in the process of **Rehabilitation** work, then ***protecting and maintaining*** them are addressed. Protection generally involves the least degree of intervention and is preparatory to other work. Protection includes the maintenance of historic materials and features as well as ensuring that the property is protected before and during rehabilitation work. A historic building undergoing rehabilitation will often require more extensive work. Thus, an overall evaluation of its physical condition should always begin at this level.

### Repair Historic Materials and Features

Next, when the physical condition of character-defining materials and features warrants additional work, ***repairing*** is recommended. **Rehabilitation** guidance for the repair of historic materials, such as masonry, again begins with the least degree of intervention possible. In rehabilitation, repairing also includes the limited replacement in kind or with a compatible substitute material of extensively deteriorated or missing components of features when there are surviving prototypes features that can be substantiated by documentary and physical evidence. Although using the same kind of material is always the preferred option, a substitute material may be an acceptable alternative if the form, design, and scale, as well as the substitute material itself, can effectively replicate the appearance of the remaining features.

### Replace Deteriorated Historic Materials and Features

Following repair in the hierarchy, **Rehabilitation** guidance is provided for ***replacing*** an entire character-defining feature with new material because the level of deterioration or damage of materials precludes repair. If the missing feature is character defining or if it is critical to the survival of the building (e.g., a roof), it should be replaced to match the historic feature based on physical or his-

toric documentation of its form and detailing. As with repair, the preferred option is always replacement of the entire feature in kind (i.e., with the same material, such as wood for wood). However, when this is not feasible, a compatible substitute material that can reproduce the overall appearance of the historic material may be considered.

It should be noted that, while the National Park Service guidelines recommend the replacement of an entire character-defining feature that is extensively deteriorated, the guidelines never recommend removal and replacement with new material of a feature that could reasonably be repaired and, thus, preserved.

## Design for the Replacement of Missing Historic Features

When an entire interior or exterior feature is missing, such as a porch, it no longer plays a role in physically defining the historic character of the building unless it can be accurately recovered in form and detailing through the process of carefully documenting the historic appearance. If the feature is not critical to the survival of the building, allowing the building to remain without the feature is one option. But if the missing feature is important to the historic character of the building, its replacement is always recommended in the **Rehabilitation** guidelines as the first, or preferred, course of action. If adequate documentary and physical evidence exists, the feature may be accurately reproduced. A second option in a rehabilitation treatment for replacing a missing feature, particularly when the available information about the feature is inadequate to permit an accurate reconstruction, is to ***design*** a new feature that is compatible with the overall historic character of the building. The new design should always take into account the size, scale, and material of the building itself and should be clearly differentiated from the authentic historic features. For properties that have changed over time, and where those changes have acquired significance, reestablishing missing historic features generally should not be undertaken if the missing features did not coexist with the features currently on the building. Juxtaposing historic features that did not exist concurrently will result in a false sense of the building's history.

## Alterations

Some exterior and interior alterations to a historic building are generally needed as part of a **Rehabilitation** project to ensure its continued use, but it is most important that such alterations do not radically change, obscure, or destroy character-defining spaces, materials, features, or finishes. Alterations may include changes to the site or setting, such as the selective removal of buildings or other features of the building site or setting that are intrusive, not character defining, or outside the building's period of significance.

## Code-Required Work: Accessibility and Life Safety

Sensitive solutions to meeting code requirements in a **Rehabilitation** project are an important part of protecting the historic character of the building. Work that must be done to meet accessibility and life-safety requirements must also be assessed for its potential impact on the historic building, its site, and setting.

## Resilience to Natural Hazards

Resilience to natural hazards should be addressed as part of a **Rehabilitation** project. A historic building may have existing characteristics or features that help to address or minimize the impacts of natural hazards. These should always be used to best advantage when considering new adaptive treatments so as to have the least impact on the historic character of the building, its site, and setting.

## Sustainability

Sustainability should be addressed as part of a **Rehabilitation** project. Good preservation practice is often synonymous with sustainability. Existing energy-efficient features should be retained and repaired. Only sustainability treatments should be considered that will have the least impact on the historic character of the building.

**The topic of sustainability is addressed in detail in *The Secretary of the Interior's Standards for Rehabilitation & Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings.***

## New Exterior Additions and Related New Construction

**Rehabilitation** is the only treatment that allows expanding a historic building by enlarging it with an addition. However, the **Rehabilitation** guidelines emphasize that new additions should be considered only after it is determined that meeting specific new needs cannot be achieved by altering non-character-defining interior spaces. If the use cannot be accommodated in this way, then an attached exterior addition may be considered. New additions should be designed and constructed so that the character-defining features of the historic building, its site, and setting are not negatively impacted. Generally, a new addition should be subordinate to the historic building. A new addition should be compatible, but differentiated enough so that it is not confused as historic or original to the building. The same guidance applies to new construction so that it does not negatively impact the historic character of the building or its site.

***Rehabilitation as a Treatment.*** *When repair and replacement of deteriorated features are necessary; when alterations or additions to the property are planned for a new or continued use; and when its depiction at a particular time is not appropriate, Rehabilitation may be considered as a treatment. Prior to undertaking work, a documentation plan for Rehabilitation should be developed.*

## **MASONRY:** STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

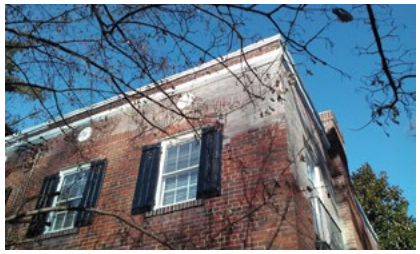
| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| ***Identifying, retaining and preserving*** masonry features that are important in defining the overall historic character of the building (such as walls, brackets, railings, cornices, window and door surrounds, steps, and columns) and decorative ornament and other details, such as tooling and bonding patterns, coatings, and color. | Removing or substantially changing masonry features which are important in defining the overall historic character of the building so that, as a result, the character is diminished.<br><br>Replacing or rebuilding a major portion of exterior masonry walls that could be repaired, thereby destroying the historic integrity of the building.<br><br>Applying paint or other coatings (such as stucco) to masonry that has been historically unpainted or uncoated to create a new appearance.<br><br>Removing paint from historically-painted masonry. |
| ***Protecting and maintaining*** masonry by ensuring that historic drainage features and systems that divert rainwater from masonry surfaces (such as roof overhangs, gutters, and downspouts) are intact and functioning properly. | Failing to identify and treat the causes of masonry deterioration, such as leaking roofs and gutters or rising damp. |
| Cleaning masonry only when necessary to halt deterioration or remove heavy soiling. | Cleaning masonry surfaces when they are not heavily soiled to create a "like-new" appearance, thereby needlessly introducing chemicals or moisture into historic materials. |
| Carrying out masonry cleaning tests when it has been determined that cleaning is appropriate. Test areas should be examined to ensure that no damage has resulted and, ideally, monitored over a sufficient period of time to allow long-range effects to be predicted. | Cleaning masonry surfaces without testing or without sufficient time for the testing results to be evaluated. |


[1] An alkaline-based product is appropriate to use to clean historic marble because it will not damage the marble, which is acid sensitive.

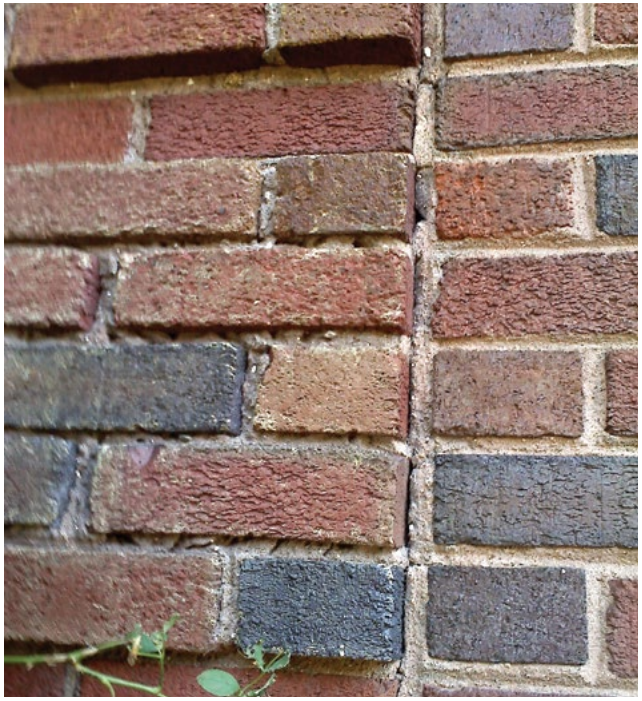
[2] Mid-century modern building technology made possible the form of this parabola-shaped structure and its thin concrete shell construction. Built in 1961 as the lobby of the La Concha Motel in Las Vegas, it was designed by Paul Revere Williams, one of the first prominent African-American architects. It was moved to a new location and rehabilitated to serve as the Neon Museum, and is often cited as an example of Googie architecture. *Credit: Photographed with permission at The Neon Museum, Las Vegas, Nevada.*

## **MASONRY:** STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Cleaning soiled masonry surfaces with the gentlest method possible, such as using low-pressure water and detergent and natural bristle or other soft-bristle brushes. | Cleaning or removing paint from masonry surfaces using most abrasive methods (including sandblasting, other media blasting, or high-pressure water) which can damage the surface of the masonry and mortar joints.<br><br>Using a cleaning or paint-removal method that involves water or liquid chemical solutions when there is any possibility of freezing temperatures.<br><br>Cleaning with chemical products that will damage some types of masonry (such as using acid on limestone or marble), or failing to neutralize or rinse off chemical cleaners from masonry surfaces. |



[3] **Not Recommended:**
The white film on the upper corner of this historic brick row house is the result of using a scrub or slurry coating, rather than traditional repointing by hand, which is the recommended method.



[4] **Not Recommended:**
The quoins on the left side of the photo show that high-pressure abrasive blasting used to remove paint can damage even early 20th-century, hard-baked, textured brick and erode the mortar, whereas the same brick on the right, which was not abrasively cleaned, is undamaged.

## **MASONRY:** STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Using biodegradable or environmentally-safe cleaning or paint-removal products. | |
| Using paint-removal methods that employ a poultice to which paint adheres, when possible, to neatly and safely remove old lead paint. | |
| Using coatings that encapsulate lead paint, when possible, where the paint is not required to be removed to meet environmental regulations. | |
| Allowing only trained conservators to use abrasive or laser-cleaning methods, when necessary, to clean hard-to-reach, highly-carved, or detailed decorative stone features. | |
| Removing damaged or deteriorated paint only to the next sound layer using the gentlest method possible (e.g., hand scraping) prior to repainting. | Removing paint that is firmly adhered to masonry surfaces, unless the building was unpainted historically and the paint can be removed without damaging the surface. |
| Applying compatible paint coating systems to historically-painted masonry following proper surface preparation. | Failing to follow manufacturers' product and application instructions when repainting masonry features. |
| Repainting historically-painted masonry features with colors that are appropriate to the historic character of the building and district. | Using paint colors on historically-painted masonry features that are not appropriate to the historic character of the building and district. |
| Protecting adjacent materials when cleaning or removing paint from masonry features. | Failing to protect adjacent materials when cleaning or removing paint from masonry features. |
| Evaluating the overall condition of the masonry to determine whether more than protection and maintenance, such as repairs to masonry features, will be necessary. | Failing to undertake adequate measures to ensure the protection of masonry features. |
| ***Repairing*** masonry by patching, splicing, consolidating, or otherwise reinforcing the masonry using recognized preservation methods. Repair may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated or missing parts of masonry features when there are surviving prototypes, such as terra-cotta brackets or stone balusters. | Removing masonry that could be stabilized, repaired, and conserved, or using untested consolidants and unskilled personnel, potentially causing further damage to historic materials.<br><br>Replacing an entire masonry feature, such as a cornice or balustrade, when repair of the masonry and limited replacement of deteriorated or missing components are feasible. |

## **MASONRY:** STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

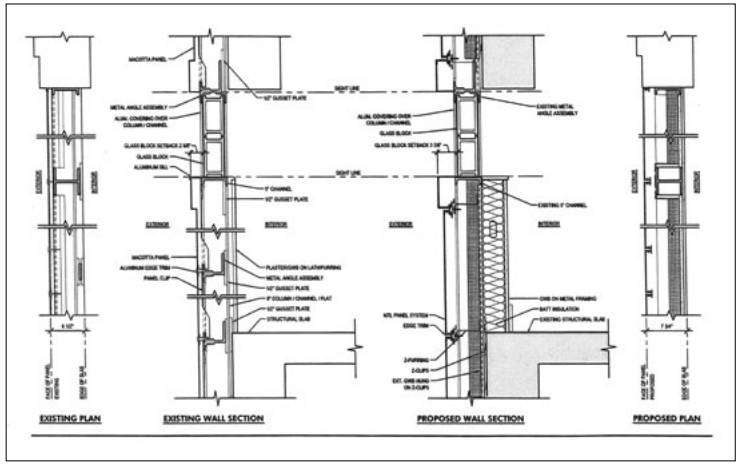
| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Repairing masonry walls and other masonry features by repointing the mortar joints where there is evidence of deterioration, such as disintegrating mortar, cracks in mortar joints, loose bricks, or damaged plaster on the interior. | Removing non-deteriorated mortar from sound joints and then repointing the entire building to achieve a more uniform appearance. |
| Removing deteriorated lime mortar carefully by hand raking the joints to avoid damaging the masonry. | |
| Using power tools only on horizontal joints on brick masonry in conjunction with hand chiseling to remove hard mortar that is deteriorated or that is a non-historic material which is causing damage to the masonry units. Mechanical tools should be used only by skilled masons in limited circumstances and generally not on short, vertical joints in brick masonry. | Allowing unskilled workers to use masonry saws or mechanical tools to remove deteriorated mortar from joints prior to repointing. |
| Duplicating historic mortar joints in strength, composition, color, and texture when repointing is necessary. In some cases, a lime-based mortar may also be considered when repointing Portland cement mortar because it is more flexible. | Repointing masonry units with mortar of high Portland cement content (unless it is the content of the historic mortar).<br><br>Using "surface grouting" or a "scrub" coating technique, such as a "sack rub" or "mortar washing," to repoint exterior masonry units instead of traditional repointing methods.<br><br>Repointing masonry units (other than concrete) with a synthetic caulking compound instead of mortar. |
| Duplicating historic mortar joints in width and joint profile when repointing is necessary. | Changing the width or joint profile when repointing. |
| Repairing stucco by removing the damaged material and patching with new stucco that duplicates the old in strength, composition, color, and texture. | Removing sound stucco or repairing with new stucco that is different in composition from the historic stucco.<br><br>Patching stucco or concrete without removing the source of deterioration.<br><br>Replacing deteriorated stucco with synthetic stucco, an exterior finish and insulation system (EFIS), or other non-traditional materials. |

## **MASONRY:** STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Using mud plaster or a compatible lime-plaster adobe render, when appropriate, to repair adobe. | Applying cement stucco, unless it already exists, to adobe. |
| Sealing joints in concrete with appropriate flexible sealants and backer rods, when necessary. | |
| Cutting damaged concrete back to remove the source of deterioration, such as corrosion on metal reinforcement bars. The new patch must be applied carefully so that it will bond satisfactorily with and match the historic concrete. | Patching damaged concrete without removing the source of deterioration. |

[5] Rebars in the reinforced concrete ceiling have rusted, causing the concrete to spall. The rebars must be cleaned of rust before the concrete can be patched.

[6] Some areas of the concrete brise soleil screen on this building constructed in 1967 are badly deteriorated. If the screen cannot be repaired, it may be replaced in kind or with a composite substitute material with the same appearance as the concrete.



[7] (a) J.W. Knapp's Department Store, built 1937-38, in Lansing, MI, was constructed with a proprietary material named "Maul Macotta" made of enameled steel and cast-in-place concrete panels. Prior to its rehabilitation, a building inspection revealed that, due to a flaw in the original design and construction, the material was deteriorated beyond repair. The architects for the rehabilitation project devised a replacement system (b) consisting of enameled aluminum panels that matched the original colors (c). Photos and drawing (a-b): Quinn Evans Architects; *Photo (c): James Haefner Photography.*

## **MASONRY:** STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Using a non-corrosive, stainless-steel anchoring system when replacing damaged stone, concrete, or terra-cotta units that have failed. | |
| Applying non-historic surface treatments, such as water-repellent coatings, to masonry only after repointing and only if masonry repairs have failed to arrest water penetration problems. | Applying waterproof, water-repellent, or non-original historic coatings (such as stucco) to masonry as a substitute for repointing and masonry repairs. |
| Applying permeable, anti-graffiti coatings to masonry when appropriate. | Applying water-repellent or anti-graffiti coatings that change the historic appearance of the masonry or that may trap moisture if the coating is not sufficiently permeable. |
| ***Replacing*** in kind an entire masonry feature that is too deteriorated to repair (if the overall form and detailing are still evident) using the physical evidence as a model to reproduce the feature or when the replacement can be based on historic documentation. Examples can include large sections of a wall, a cornice, pier, or parapet. If using the same kind of material is not feasible, then a compatible substitute material may be considered. | Removing a masonry feature that is unrepairable and not replacing it, or replacing it with a new feature that does not match.<br><br>Using substitute material for the replacement that does not convey the same appearance of the surviving components of the masonry feature. |
| *The following work is highlighted to indicate that it is specific to* **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.* | |
| **Designing the Replacement for Missing Historic Features** | |
| Designing and installing a replacement masonry feature, such as a step or door pediment, when the historic feature is completely missing. It may be an accurate restoration based on documentary and physical evidence, but only when the historic feature to be replaced coexisted with the features currently on the building. Or, it may be a new design that is compatible with the size, scale, material, and color of the historic building. | Creating an inaccurate appearance because the replacement for the missing masonry feature is based upon insufficient physical or historic documentation, is not a compatible design, or because the feature to be replaced did not coexist with the features currently on the building.<br><br>Introducing a new masonry feature that is incompatible in size, scale, material, or color. |

## **WOOD:** CLAPBOARD, WEATHERBOARD, SHINGLES, AND OTHER FUNCTIONAL AND DECORATIVE ELEMENTS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| ***Identifying, retaining and preserving*** wood features that are important in defining the overall historic character of the building (such as siding, cornices, brackets, window and door surrounds, and steps) and their paints, finishes, and colors. | Removing or substantially changing wood features which are important in defining the overall historic character of the building so that, as a result, the character is diminished.<br><br>Removing a major portion of the historic wood from a façade instead of repairing or replacing only the deteriorated wood, then reconstructing the façade with new material to achieve a uniform or "improved" appearance.<br><br>Changing the type of finish, coating, or historic color of wood features, thereby diminishing the historic character of the exterior.<br><br>Failing to renew failing paint or other coatings that are historic finishes.<br><br>Stripping historically-painted surfaces to bare wood and applying a clear finish rather than repainting.<br><br>Stripping paint or other coatings to reveal bare wood, thereby exposing historically-coated surfaces to the effects of accelerated weathering.<br><br>Removing wood siding (clapboards) or other covering (such as stucco) from log structures that were covered historically, which changes their historic character and exposes the logs to accelerated deterioration. |
| ***Protecting and maintaining*** wood features by ensuring that historic drainage features that divert rainwater from wood surfaces (such as roof overhangs, gutters, and downspouts) are intact and functioning properly. | Failing to identify and treat the causes of wood deterioration, such as faulty flashing, leaking gutters, cracks and holes in siding, deteriorated caulking in joints and seams, plant material growing too close to wood surfaces, or insect or fungal infestation. |

## **WOOD:** CLAPBOARD, WEATHERBOARD, SHINGLES, AND OTHER FUNCTIONAL AND DECORATIVE ELEMENTS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Applying chemical preservatives or paint to wood features that are subject to weathering, such as exposed beam ends, outriggers, or rafter tails. | Using chemical preservatives (such as creosote) which, unless they were used historically, can change the appearance of wood features. |
| Implementing an integrated pest management plan to identify appropriate preventive measures to guard against insect damage, such as installing termite guards, fumigating, and treating with chemicals. | |
| Retaining coatings (such as paint) that protect the wood from moisture and ultraviolet light. Paint removal should be considered only when there is paint surface deterioration and as part of an overall maintenance program which involves repainting or applying other appropriate coatings. | Stripping paint or other coatings from wood features without recoating. |

[8] Rotted clapboards have been replaced selectively with new wood siding to match the originals.

## **WOOD:** CLAPBOARD, WEATHERBOARD, SHINGLES, AND OTHER FUNCTIONAL AND DECORATIVE ELEMENTS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Removing damaged or deteriorated paint to the next sound layer using the gentlest method possible (e.g., hand scraping and hand sanding) prior to repainting. | Using potentially-damaging paint-removal methods on wood surfaces, such as open-flame torches, orbital sanders, abrasive methods (including sandblasting, other media blasting, or high-pressure water), or caustic paint-removers.<br><br>Removing paint that is firmly adhered to wood surfaces. |
| Using chemical strippers primarily to supplement other methods such as hand scraping, hand sanding, and thermal devices. | Failing to neutralize the wood thoroughly after using chemical paint removers so that new paint may not adhere.<br><br>Removing paint from detachable wood features by soaking them in a caustic solution, which may roughen the surface, split the wood, or result in staining from residual acids leaching out of the wood. |
| Using biodegradable or environmentally-safe cleaning or paint-removal products. | |
| Using paint-removal methods that employ a poultice to which paint adheres, when possible, to neatly and safely remove old lead paint. | |
| Using thermal devices (such as infrared heaters) carefully to remove paint when it is so deteriorated that total removal is necessary prior to repainting. | Using a thermal device to remove paint from wood features without first checking for and removing any flammable debris behind them.<br><br>Using thermal devices without limiting the amount of time the wood feature is exposed to heat. |
| Using coatings that encapsulate lead paint, when possible, where the paint is not required to be removed to meet environmental regulations. | |
| Applying compatible paint coating systems to historically-painted wood following proper surface preparation. | Failing to follow manufacturers' product and application instructions when repainting wood features. |
| Repainting historically-painted wood features with colors that are appropriate to the building and district. | Using paint colors on historically-painted wood features that are not appropriate to the building or district. |

## **WOOD:** CLAPBOARD, WEATHERBOARD, SHINGLES, AND OTHER FUNCTIONAL AND DECORATIVE ELEMENTS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Protecting adjacent materials when working on other wood features. | Failing to protect adjacent materials when working on wood features. |
| Evaluating the overall condition of the wood to determine whether more than protection and maintenance, such as repairs to wood features, will be necessary. | Failing to undertake adequate measures to ensure the protection of wood features. |

[9] Smooth-surfaced cementitious siding (left) may be used to replace deteriorated wood siding only on secondary elevations that have minimal visibility.

[10] **Not Recommended:** Cementitious siding with a raised wood-grain texture is not an appropriate material to replace historic wood siding, which has a smooth surface when painted.

## **WOOD:** CLAPBOARD, WEATHERBOARD, SHINGLES, AND OTHER FUNCTIONAL AND DECORATIVE ELEMENTS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| ***Repairing*** wood by patching, splicing, consolidating, or otherwise reinforcing the wood using recognized conservation methods. Repair may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated or missing components of wood features when there are surviving prototypes, such as brackets, molding, or sections of siding. | Removing wood that could be stabilized, repaired, and conserved, or using untested consolidants and unskilled personnel, potentially causing further damage to historic materials.<br><br>Replacing an entire wood feature, such as a cornice or balustrade, when repair of the wood and limited replacement of deteriorated or missing components is feasible. |
| ***Replacing*** in kind an entire wood feature that is too deteriorated to repair (if the overall form and detailing are still evident) using physical evidence as a model to reproduce the feature or when the replacement can be based on historic documentation. Examples of such wood features include a cornice, entablature, or a balustrade. If using wood is not feasible, then a compatible substitute material may be considered. | Removing a wood feature that is unrepairable and not replacing it, or replacing it with a new feature that does not match.<br><br>Using substitute material for the replacement that does not convey the same appearance of the surviving components of the wood feature. |
| Replacing a deteriorated wood feature or wood siding on a *primary or other highly-visible* elevation with a new matching wood feature. | Replacing a deteriorated wood feature or wood siding on a *primary or other highly-visible elevation* with a composite substitute material. |
| *The following work is highlighted to indicate that it is specific to* **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.* | |
| **Designing the Replacement for Missing Historic Features** | |
| Designing and installing a replacement masonry feature, such as a step or door pediment, when the historic feature is completely missing. It may be an accurate restoration based on documentary and physical evidence, but only when the historic feature to be replaced coexisted with the features currently on the building. Or, it may be a new design that is compatible with the size, scale, material, and color of the historic building. | Creating an inaccurate appearance because the replacement for the missing masonry feature is based upon insufficient physical or historic documentation, is not a compatible design, or because the feature to be replaced did not coexist with the features currently on the building.<br><br>Introducing a new wood feature that is incompatible in size, scale, material, or color. |

## **METALS:** WROUGHT AND CAST IRON, STEEL, PRESSED METAL, TERNEPLATE, COPPER, ALUMINUM, AND ZINC

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| ***Identifying, retaining, and preserving*** metal features that are important in defining the overall historic character of the building (such as columns, capitals, pilasters, spandrel panels, or stairways) and their paints, finishes, and colors. The type of metal should be identified prior to work because each metal has its own properties and may require a different treatment. | Removing or substantially changing metal features which are important in defining the overall historic character of the building so that, as a result, the character is diminished.<br><br>Removing a major portion of the historic metal from a façade instead of repairing or replacing only the deteriorated metal, then reconstructing the façade with new material to achieve a uniform or "improved" appearance. |
| ***Protecting and maintaining*** metals from corrosion by providing proper drainage so that water does not stand on flat, horizontal surfaces or accumulate in curved decorative features. | Failing to identify and treat the causes of corrosion, such as moisture from leaking roofs or gutters.<br><br>Placing incompatible metals together without providing an appropriate separation material. Such incompatibility can result in galvanic corrosion of the less noble metal (e.g., copper will corrode cast iron, steel, tin, and aluminum). |
| Cleaning metals when necessary to remove corrosion prior to repainting or applying appropriate protective coatings. | Leaving metals that must be protected from corrosion uncoated after cleaning. |

[11] The stainless steel doors at the entrance to this Art Deco apartment building are important in defining its historic character and should be retained in place.

## **METALS:** WROUGHT AND CAST IRON, STEEL, PRESSED METAL, TERNEPLATE, COPPER, ALUMINUM, AND ZINC

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Identifying the particular type of metal prior to any cleaning procedure and then testing to ensure that the gentlest cleaning method possible is selected; or, alternatively, determining that cleaning is inappropriate for the particular metal. | Using cleaning methods which alter or damage the color, texture, or finish of the metal, or cleaning when it is inappropriate for the particular metal.<br><br>Removing the patina from historic metals. The patina may be a protective layer on some metals (such as bronze or copper) as well as a distinctive finish. |
| Using non-corrosive chemical methods to clean soft metals (such as lead, tinplate, terneplate, copper, and zinc) whose finishes can be easily damaged by abrasive methods. | Cleaning soft metals (such as lead, tinplate, terneplate, copper, and zinc) with abrasive methods (including sandblasting, other abrasive media, or high-pressure water) which will damage the surface of the metal. |
| Using the least abrasive cleaning method for hard metals (such as cast iron, wrought iron, and steel) to remove paint buildup and corrosion. If hand scraping and wire brushing have proven ineffective, low-pressure abrasive methods may be used as long as they do not abrade or damage the surface. | Using high-pressure abrasive techniques (including sandblasting, other media blasting, or high-pressure water) without first trying gentler cleaning methods prior to cleaning cast iron, wrought iron, or steel. |
| Applying appropriate paint or other coatings to historically-coated metals after cleaning to protect them from corrosion. | Applying paint or other coatings to metals (such as copper, bronze or stainless steel) if they were not coated historically, unless a coating is necessary for maintenance. |
| Repainting historically-painted metal features with colors that are appropriate to the building and district. | Using paint colors on historically-painted metal features that are not appropriate to the building or district. |
| Applying an appropriate protective coating (such as lacquer or wax) to a metal feature that was historically unpainted, such as a bronze door, which is subject to heavy use. | |

# **METALS:** WROUGHT AND CAST IRON, STEEL, PRESSED METAL, TERNEPLATE, COPPER, ALUMINUM, AND ZINC

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Protecting adjacent materials when cleaning or removing paint from metal features. | Failing to protect adjacent materials when working on metal features. |
| Evaluating the overall condition of metals to determine whether more than protection and maintenance, such as repairs to metal features, will be necessary. | Failing to undertake adequate measures to ensure the protection of metal features. |

[12] This historic steel window has been cleaned, repaired, and primed in preparation for painting and reglazing.

[13] The gold-colored, anodized aluminum geodesic dome of the former Citizen's State Bank in Oklahoma City, OK, built in 1958 and designed by Robert Roloff, makes this a distinctive mid-20th century building.

[14] Interior cast-iron columns have been cleaned and repainted as part of the rehabilitation of this historic market building for continuing use.

[15] New enameled-metal panels were replicated to replace the original panels, which were too deteriorated to repair, when the storefront of this early 1950s building was recreated.

# METALS: WROUGHT AND CAST IRON, STEEL, PRESSED METAL, TERNEPLATE, COPPER, ALUMINUM, AND ZINC

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| ***Repairing*** metal by reinforcing the metal using recognized preservation methods. Repair may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated or missing components of features when there are surviving prototypes, such as column capitals or bases, storefronts, railings and steps, or window hoods. | Removing metals that could be stabilized, repaired, and conserved, or using improper repair techniques, or unskilled personnel, potentially causing further damage to historic materials. |
| ***Replacing*** in kind an entire metal feature that is too deteriorated to repair (if the overall form and detailing are still evident) using the physical evidence as a model to reproduce the feature or when the replacement can be based on historic documentation. Examples of such a feature could include cast-iron porch steps or steel-sash windows. If using the same kind of material is not feasible, then a compatible substitute material may be considered. | Replacing an entire metal feature, such as a column or balustrade, when repair of the metal and limited replacement of deteriorated or missing components are feasible.<br><br>Removing a metal feature that is unrepairable and not replacing it, or replacing it with a new metal feature that does not match.<br><br>Using a substitute material for the replacement that does not convey the same appearance of the surviving components of the metal feature or that is physically or chemically incompatible. |
| *The following work is highlighted to indicate that it is specific to* **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.* | |
| **Designing the Replacement for Missing Historic Features** | |
| Designing and installing a replacement metal feature, such as a metal cornice or cast-iron column, when the historic feature is completely missing. It may be an accurate restoration based on documentary and physical evidence, but only when the historic feature to be replaced coexisted with the features currently on the building. Or, it may be a new design that is compatible with the size, scale, material, and color of the historic building. | Creating an inaccurate appearance because the replacement for the missing metal feature is based upon insufficient physical or historic documentation, is not a compatible design, or because the feature to be replaced did not coexist with the features currently on the building.<br><br>Introducing a new metal feature that is incompatible in size, scale, material, or color. |

## ROOFS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| ***Identifying, retaining, and preserving*** roofs and their functional and decorative features that are important in defining the overall historic character of the building. The form of the roof (gable, hipped, gambrel, flat, or mansard) is significant, as are its decorative and functional features (such as cupolas, cresting, parapets, monitors, chimneys, weather vanes, dormers, ridge tiles, and snow guards), roofing material (such as slate, wood, clay tile, metal, roll roofing, or asphalt shingles), and size, color, and patterning. | Removing or substantially changing roofs which are important in defining the overall historic character of the building so that, as a result, the character is diminished.<br><br>Removing a major portion of the historic roof or roofing material that is repairable, then rebuilding it with new material to achieve a more uniform or "improved" appearance.<br><br>Changing the configuration or shape of a roof by adding highly visible new features (such as dormer windows, vents, skylights, or a penthouse).<br><br>Stripping the roof of sound historic material, such as slate, clay tile, wood, or metal. |
| ***Protecting and maintaining*** a roof by cleaning gutters and downspouts and replacing deteriorated flashing. Roof sheathing should also be checked for indications of moisture due to leaks or condensation. | Failing to clean and maintain gutters and downspouts properly so that water and debris collect and cause damage to roof features, sheathing, and the underlying roof structure. |
| Providing adequate anchorage for roofing material to guard against wind damage and moisture penetration. | Allowing flashing, caps, and exposed fasteners to corrode, which accelerates deterioration of the roof. |
| Protecting a leaking roof with a temporary waterproof membrane with a synthetic underlayment, roll roofing, plywood, or a tarpaulin until it can be repaired. | Leaving a leaking roof unprotected so that accelerated deterioration of historic building materials (such as masonry, wood, plaster, paint, and structural members) occurs. |
| Repainting a roofing material that requires a protective coating and was painted historically (such as a terneplate metal roof or gutters) as part of regularly-scheduled maintenance. | Failing to repaint a roofing material that requires a protective coating and was painted historically as part of regularly-scheduled maintenance. |
| Applying compatible paint coating systems to historically-painted roofing materials following proper surface preparation. | Applying paint or other coatings to roofing material if they were not coated historically. |
| Protecting a roof covering when working on other roof features. | Failing to protect roof coverings when working on other roof features. |
| Evaluating the overall condition of the roof and roof features to determine whether more than protection and maintenance, such as repairs to roof features, will be necessary. | Failing to undertake adequate measures to ensure the protection of roof features. |

# ROOFS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| ***Repairing*** a roof by ensuring that the existing historic or compatible non-historic roof covering is sound and waterproof. Repair may include the limited replacement in kind or with a compatible substitute material of missing materials (such as wood shingles, slates, or tiles) on a main roof, as well as those extensively deteriorated or missing components of features when there are surviving prototypes, such as ridge tiles, dormer roofing, or roof monitors.<br><br>Using corrosion-resistant roof fasteners (e.g., nails and clips) to repair a roof to help extend its longevity. | Replacing an entire roof feature when repair of the historic roofing materials and limited replacement of deteriorated or missing components are feasible. |

[16] The deteriorated asphalt shingles of this porch roof are being replaced in kind with matching shingles.

# ROOFS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| ***Replacing*** in kind an entire roof covering or feature that is too deteriorated to repair (if the overall form and detailing are still evident) using the physical evidence as a model to reproduce the feature or when the replacement can be based on historic documentation. Examples of such a feature could include a large section of roofing, a dormer, or a chimney. If using the same kind of material is not feasible, then a compatible substitute material may be considered. | Removing a feature of the roof that is unrepairable and not replacing it, or replacing it with a new roof feature that does not match.<br><br>Using a substitute material for the replacement that does not convey the same appearance of the roof covering or the surviving components of the roof feature or that is physically or chemically incompatible. |
| Replacing only missing or damaged roofing tiles or slates rather than replacing the entire roof covering. | Failing to reuse intact slate or tile in good condition when only the roofing substrate or fasteners need replacement. |
| Replacing an incompatible roof covering or any deteriorated non-historic roof covering with historically-accurate roofing material, if known, or another material that is compatible with the historic character of the building. | |
| *The following work is highlighted to indicate that it is specific to* **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.* | |
| **Designing the Replacement for Missing Historic Features** | |
| Designing and installing a new roof covering for a missing roof or a new feature, such as a dormer or a monitor, when the historic feature is completely missing. It may be an accurate restoration based on documentary and physical evidence, but only when the historic feature to be replaced coexisted with the features currently on the building. Or, it may be a new design that is compatible with the size, scale, material, and color of the historic building. | Creating an inaccurate appearance because the replacement for the missing roof feature is based upon insufficient physical or historic documentation, is not a compatible design, or because the feature to be replaced did not coexist with the features currently on the building.<br><br>Introducing a new roof feature that is incompatible in size, scale, material, or color. |

# ROOFS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| **Alterations and Additions for a New Use** | |
| Installing mechanical and service equipment on the roof (such as heating and air-conditioning units, elevator housing, or solar panels) when required for a new use so that they are inconspicuous on the site and from the public right-of-way and do not damage or obscure character-defining historic features. | Installing roof-top mechanical or service equipment so that it damages or obscures character-defining roof features or is conspicuous on the site or from the public right-of-way. |
| Designing rooftop additions, elevator or stair towers, decks or terraces, dormers, or skylights when required by a new or continuing use so that they are inconspicuous and minimally visible on the site and from the public right-of-way and do not damage or obscure character-defining historic features. | Changing a character-defining roof form, or damaging or destroying character-defining roofing material as a result of an incompatible rooftop addition or improperly-installed or highly-visible mechanical equipment. |
| Installing a green roof or other roof landscaping, railings, or furnishings that are not visible on the site or from the public right-of-way and do not damage the roof structure. | Installing a green roof or other roof landscaping, railings, or furnishings that are visible on the site and from the public right-of-way. |

[17] New wood elements have been used selectively to replace rotted wood on the underside of the roof in this historic warehouse.

## WINDOWS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| ***Identifying, retaining, and preserving*** windows and their functional and decorative features that are important to the overall character of the building. The window material and how the window operates (e.g., double hung, casement, awning, or hopper) are significant, as are its components (including sash, muntins, ogee lugs, glazing, pane configuration, sills, mullions, casings, or brick molds) and related features, such as shutters. | Removing or substantially changing windows or window features which are important in defining the overall historic character of the building so that, as a result, the character is diminished.<br><br>Changing the appearance of windows that contribute to the historic character of the building by replacing materials, finishes, or colors which noticeably change the sash, depth of the reveal, and muntin configurations; the reflectivity and color of the glazing; or the appearance of the frame.<br><br>Obscuring historic wood window trim with metal or other material.<br><br>Replacing windows solely because of peeling paint, broken glass, stuck sash, or high air infiltration. These conditions, in themselves, do not indicate that windows are beyond repair. |
| ***Protecting and maintaining*** the wood or metal which comprises the window jamb, sash, and trim through appropriate treatments, such as cleaning, paint removal, and reapplication of protective coating systems. | Failing to protect and maintain window materials on a cyclical basis so that deterioration of the window results. |
| Protecting windows against vandalism before work begins by covering them and by installing alarm systems that are keyed into local protection agencies. | Leaving windows unprotected and subject to vandalism before work begins, thereby also allowing the interior to be damaged if it can be accessed through unprotected windows. |
| Making windows weathertight by recaulking gaps in fixed joints and replacing or installing weatherstripping. | |
| Protecting windows from chemical cleaners, paint, or abrasion during work on the exterior of the building. | Failing to protect historic windows from chemical cleaners, paint, or abrasion when work is being done on the exterior of the building. |
| Protecting and retaining historic glass when replacing putty or repairing other components of the window. | Failing to protect the historic glass when making window repairs. |

## WINDOWS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Sustaining the historic operability of windows by lubricating friction points and replacing broken components of the operating system (such as hinges, latches, sash chains or cords) and replacing deteriorated gaskets or insulating units. | Failing to maintain windows and window components so that windows are inoperable, or sealing operable sash permanently.<br><br>Failing to repair and reuse window hardware such as sash lifts, latches, and locks. |
| Adding storm windows with a matching or a one-over-one pane configuration that will not obscure the characteristics of the historic windows. Storm windows improve energy efficiency and are especially beneficial when installed over wood windows because they also protect them from accelerated deterioration. | |
| Adding interior storm windows as an alternative to exterior storm windows when appropriate. | |

[18] The historic metal storm windows in this 1920s office building were retained and repaired during the rehabilitation project.

[19] Installing a mockup of a proposed replacement window can be helpful to evaluate how well the new windows will match the historic windows that are missing or too deteriorated to repair.


[20 a-d] The original steel windows in this industrial building were successfully repaired as part of the rehabilitation project (left).

## WINDOWS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Installing sash locks, window guards, removable storm windows, and other reversible treatments to meet safety, security, or energy conservation requirements. | |
| Evaluating the overall condition of the windows to determine whether more than protection and maintenance, such as repairs to windows and window features, will be necessary. | Failing to undertake adequate measures to ensure the protection of window features. |
| ***Repairing*** window frames and sash by patching, splicing, consolidating, or otherwise reinforcing them using recognized preservation methods. Repair may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated, broken, or missing components of features when there are surviving prototypes, such as sash, sills, hardware, or shutters. | Removing window features that could be stabilized, repaired, or conserved using untested consolidants, improper repair techniques, or unskilled personnel, potentially causing further damage to the historic materials.<br><br>Replacing an entire window when repair of the window and limited replacement of deteriorated or missing components are feasible. |
| Removing glazing putty that has failed and applying new putty; or, if glass is broken, carefully removing all putty, replacing the glass, and reputtying. | |
| Installing new glass to replace broken glass which has the same visual characteristics as the historic glass. | |
| ***Replacing*** in kind an entire window that is too deteriorated to repair (if the overall form and detailing are still evident) using the physical evidence as a model to reproduce the feature or when the replacement can be based on historic documentation. If using the same kind of material is not feasible, then a compatible substitute material may be considered. | Removing a character-defining window that is unrepairable or is not needed for the new use and blocking up the opening, or replacing it with a new window that does not match.<br><br>Using substitute material for the replacement that does not convey the same appearance of the surviving components of the window or that is physically incompatible. |


[21] The windows on the lower floor, which were too deteriorated to repair, were replaced with new steel windows matching the upper-floor historic windows that were retained.

## WINDOWS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Modifying a historic single-glazed sash to accommodate insulated glass when it will not jeopardize the soundness of the sash or significantly alter its appearance. | Modifying a historic single-glazed sash to accommodate insulated glass when it will jeopardize the soundness of the sash or significantly alter its appearance. |
| Using low-e glass with the least visible tint in new or replacement windows. | Using low-e glass with a dark tint in new or replacement windows, thereby negatively impacting the historic character of the building. |
| Using window grids rather than true divided lights on windows on the upper floors of high-rise buildings if they will not be noticeable. | Using window grids rather than true divided lights on windows in low-rise buildings or on lower floors of high-rise buildings where they will be noticeable, resulting in a change to the historic character of the building. |
| Ensuring that spacer bars in between double panes of glass are the same color as the window sash. | Using spacer bars in between double panes of glass that are not the same color as the window sash. |
| Replacing all of the components in a glazing system if they have failed because of faulty design or materials that have deteriorated with new material that will improve the window performance without noticeably changing the historic appearance. | Replacing all of the components in a glazing system with new material that will noticeably change the historic appearance. |
| Replacing incompatible, non-historic windows with new windows that are compatible with the historic character of the building; or reinstating windows in openings that have been filled in. | |
| *The following work is highlighted to indicate that it is specific to* **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.* | |
| **Designing the Replacement for Missing Historic Features** | |
| Designing and installing a new window or its components, such as frames, sash, and glazing, when the historic feature is completely missing. It may be an accurate restoration based on documentary and physical evidence, but only when the historic feature to be replaced coexisted with the features currently on the building. Or, it may be a new design that is compatible with the size, scale, material, and color of the historic building. | Creating an inaccurate appearance because the replacement for the missing window is based upon insufficient physical or historic documentation, is not a compatible design, or because the feature to be replaced did not coexist with the features currently on the building.<br><br>Installing replacement windows made from other materials that are not the same as the material of the original windows if they would have a noticeably different appearance from the remaining historic windows. |


(a)


(b)


(c)

[22] **Not Recommended:** (a-b) The original wood windows in this late-19th-century building, which were highly decorative, could likely have been repaired and retained. (c) Instead, they were replaced with new windows that do not match the detailing of the historic windows and, therefore, do not meet the Standards (above).

[23] (a)This deteriorated historic wood window was repaired and retained (b) in this rehabilitation project.

# WINDOWS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| **Alterations and Additions for a New Use** | |
| Adding new window openings on rear or other secondary, less-visible elevations, if required by a new use. The new openings and the windows in them should be compatible with the overall design of the building but, in most cases, not duplicate the historic fenestration. | Changing the number, location, size, or glazing pattern of windows on primary or highly-visible elevations which will alter the historic character of the building.<br><br>Cutting new openings on character-defining elevations or cutting new openings that damage or destroy significant features.<br><br>Adding balconies at existing window openings or new window openings on primary or other highly-visible elevations where balconies never existed and, therefore, would be incompatible with the historic character of the building. |
| Replacing windows that are too deteriorated to repair using the same sash and pane configuration, but with new windows that operate differently, if necessary, to accommodate a new use. Any change must have minimal visual impact. Examples could include replacing hopper or awning windows with casement windows, or adding a realigned and enlarged operable portion of industrial steel windows to meet life-safety codes. | Replacing a window that contributes to the historic character of the building with a new window that is different in design (such as glass divisions or muntin profiles), dimensions, materials (wood, metal, or glass), finish or color, or location that will have a noticeably different appearance from the historic windows, which may negatively impact the character of the building. |
| Installing impact-resistant glazing, when necessary for security, so that it is compatible with the historic windows and does not damage them or negatively impact their character. | Installing impact-resistant glazing, when necessary for security, that is incompatible with the historic windows and that damages them or negatively impacts their character. |
| Using compatible window treatments (such as frosted glass, appropriate shades or blinds, or shutters) to retain the historic character of the building when it is necessary to conceal mechanical equipment, for example, that the new use requires be placed in a location behind a window or windows on a primary or highly-visible elevation. | Removing a character-defining window to conceal mechanical equipment or to provide privacy for a new use of the building by blocking up the opening. |

[24] Rotted boards in the beaded-board porch ceiling are being replaced with new matching beaded board.

## ENTRANCES AND PORCHES

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| ***Identifying, retaining, and preserving*** entrances and porches and their functional and decorative features that are important in defining the overall historic character of the building. The materials themselves (including masonry, wood, and metal) are significant, as are their features, such as doors, transoms, pilasters, columns, balustrades, stairs, roofs, and projecting canopies. | Removing or substantially changing entrances and porches which are important in defining the overall historic character of the building so that, as a result, the character is diminished.<br><br>Cutting new entrances on a primary façade.<br><br>Altering utilitarian or service entrances so they compete visually with the historic primary entrance; increasing their size so that they appear significantly more important; or adding decorative details that cannot be documented to the building or are incompatible with the building's historic character. |
| Retaining a historic entrance or porch even though it will no longer be used because of a change in the building's function. | Removing a historic entrance or porch that will no longer be required for the building's new use. |
| ***Protecting and maintaining*** the masonry, wood, and metals which comprise entrances and porches through appropriate surface treatments, such as cleaning, paint removal, and reapplication of protective coating systems. | Failing to protect and maintain entrance and porch materials on a cyclical basis so that deterioration of entrances and porches results. |
| Protecting entrances and porches against arson and vandalism before work begins by covering them and by installing alarm systems keyed into local protection agencies. | Leaving entrances and porches unprotected and subject to vandalism before work begins, thereby also allowing the interior to be damaged if it can be accessed through unprotected entrances. |
| Protecting entrance and porch features when working on other features of the building. | Failing to protect materials and features when working on other features of the building. |
| Evaluating the overall condition of entrances and porches to determine whether more than protection and maintenance, such as repairs to entrance and porch features, will be necessary. | Failing to undertake adequate measures to ensure the protection of entrance and porch features. |
| ***Repairing*** entrances and porches by patching, splicing, consolidating, and otherwise reinforcing them using recognized preservation methods. Repair may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated features or missing components of features when there are surviving prototypes, such as balustrades, columns, and stairs. | Removing entrances and porches that could be stabilized, repaired, and conserved, or using untested consolidants, improper repair techniques, or unskilled personnel, potentially causing further damage to historic materials.<br><br>Replacing an entire entrance or porch feature when repair of the feature and limited replacement of deteriorated or missing components are feasible. |

## ENTRANCES AND PORCHES

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| ***Replacing*** in kind an entire entrance or porch that is too deteriorated to repair (if the overall form and detailing are still evident) using the physical evidence as a model to reproduce the feature or when the replacement can be based on historic documentation. If using the same kind of material is not feasible, then a compatible substitute material may be considered. | Removing an entrance or porch that is unrepairable and not replacing it, or replacing it with a new entrance or porch that does not match.<br><br>Using a substitute material for the replacement that does not convey the same appearance of the surviving components of entrance or porch features or that is physically incompatible. |


[25] The new infill designs for the garage door openings in this commercial building (a) converted for restaurant use and in this mill building (b) rehabilitated for residential use are compatible with the historic character of the buildings.

## ENTRANCES AND PORCHES

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| *The following work is highlighted to indicate that it is specific to* **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.* | |
| **Designing the Replacement for Missing Historic Features** | |
| Designing and installing a new entrance or porch when the historic feature is completely missing or has previously been replaced by one that is incompatible. It may be an accurate restoration based on documentary and physical evidence, but only when the historic entrance or porch to be replaced coexisted with the features currently on the building. Or, it may be a new design that is compatible with the size, scale, material, and color of the historic building. | Creating an inaccurate appearance because the replacement for the missing entrance or porch is based upon insufficient physical or historic documentation, is not a compatible design, or because the feature to be replaced did not coexist with the features currently on the building. |
| **Alterations and Additions for a New Use** | |
| Enclosing historic porches on secondary elevations only, when required by a new use, in a manner that preserves the historic character of the building (e.g., using large sheets of glass and recessing the enclosure wall behind existing posts and balustrades). | Enclosing porches in a manner that results in a diminution or loss of historic character by using solid materials rather than clear glazing, or by placing the enclosure in front of, rather than behind, the historic features. |
| Designing and constructing additional entrances or porches on secondary elevations when required for the new use in a manner that preserves the historic character of the building (i.e., ensuring that the new entrance or porch is clearly subordinate to historic primary entrances or porches). | Constructing secondary or service entrances and porches that are incompatible in size and scale or detailing with the historic building or that obscure, damage, or destroy character-defining features. |

[26] **Not Recommended:** Installing a screened enclosure is never recommended on a front or otherwise prominent historic porch. In limited instances, it may be possible to add screening on a porch at the rear or on a secondary façade; however, the enclosure should match the color of the porch and be placed behind columns and railings so that it does not obscure these features.

# STOREFRONTS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| ***Identifying, retaining, and preserving*** storefronts and their functional and decorative features that are important in defining the overall historic character of the building. The storefront materials (including wood, masonry, metals, ceramic tile, clear glass, and pigmented structural glass) and the configuration of the storefront are significant, as are features, such as display windows, base panels, bulkheads, signs, doors, transoms, kick plates, corner posts, piers, and entablatures. The removal of inappropriate, non-historic cladding, false mansard roofs, and other later, non-significant alterations can help reveal the historic character of the storefront. | Removing or substantially changing storefronts and their features which are important in defining the overall historic character of the building so that, as a result, the character is diminished.<br><br>Changing the storefront so that it has a residential rather than commercial appearance.<br><br>Introducing features from an earlier period that are not compatible with the historic character of the storefront.<br><br>Changing the location of the storefront's historic main entrance.<br><br>Replacing or covering a glass transom with solid material or inappropriate signage, or installing an incompatible awning over it. |
| Retaining later, non-original features that have acquired significance over time. | Removing later features that may have acquired significance. |


[28] This new storefront, which replaced one that was missing, is compatible with the historic character of the building.

## STOREFRONTS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| ***Protecting and maintaining*** masonry, wood, glass, ceramic tile, and metals which comprise storefronts through appropriate treatments, such as cleaning, paint removal, and reapplication of protective coating systems. | Failing to protect and maintain storefront materials on a cyclical basis so that deterioration of storefront features results. |
| Protecting storefronts against arson and vandalism before work begins by covering windows and doors and by installing alarm systems keyed into local protection agencies. | Leaving the storefront unprotected and subject to vandalism before work begins, thereby also allowing the interior to be damaged if it can be accessed through unprotected entrances. |
| Protecting the storefront when working on other features of the building. | Failing to protect the storefront when working on other features of the building. |
| Evaluating the overall condition of the storefront to determine whether more than protection and maintenance, such as repairs to storefront features, will be necessary. | Failing to undertake adequate measures to ensure the protection of storefront features. |

[27] This original c. 1940s storefront, with its character-defining angled and curved glass display window and recessed entrance with a decorative terrazzo paving, is in good condition and should be retained in a rehabilitation project.

# STOREFRONTS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| ***Repairing*** storefronts by patching, splicing, consolidating, or otherwise reinforcing them using recognized preservation methods. Repair may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated or missing components of storefronts when there are surviving prototypes, such as transoms, base panels, kick plates, piers, or signs. | Removing storefronts that could be stabilized, repaired, and conserved, or using untested consolidants, improper repair techniques, or unskilled personnel, potentially causing further damage to historic materials. |
| ***Replacing*** in kind an entire storefront that is too deteriorated to repair (if the overall form and detailing are still evident) using the physical evidence as a model to reproduce the feature or when the replacement can be based on historic documentation. If using the same kind of material is not feasible, then a compatible substitute material may be considered. | Replacing a storefront feature when repair of the feature and limited replacement of deteriorated or missing components are feasible.<br><br>Using a substitute material for the replacement that does not convey the same appearance of the surviving components of the storefront or that is physically incompatible.<br><br>Removing a storefront that is unrepairable and not replacing it or replacing it with a new storefront that does not match. |
| *The following work is highlighted to indicate that it is specific to* **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.* | |
| **Designing the Replacement for Missing Historic Features** | |
| Designing and installing a new storefront when the historic storefront is completely missing or has previously been replaced by one that is incompatible. It may be an accurate restoration based on documentary and physical evidence, but only when the historic storefront to be replaced coexisted with the features currently on the building. Or, it may be a new design that is compatible with the size, scale, material, and color of the historic building. | Creating an inaccurate appearance because the replacement for the missing storefront is based upon insufficient physical or historic documentation, is not a compatible design, or because the feature to be replaced did not coexist with the features currently on the building.<br><br>Using new, over-scaled, or internally-lit signs unless there is a historic precedent for them or using other types of signs that obscure, damage, or destroy character-defining features of the storefront and the building. |

## STOREFRONTS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Replacing missing awnings or canopies that can be historically documented to the building, or adding new signage, awnings, or canopies that are compatible with the historic character of the building. | Adding vinyl awnings, or other awnings that are inappropriately sized or shaped, which are incompatible with the historic character of the building; awnings that do not extend over the entire length of the storefront; or large canopies supported by posts that project out over the sidewalk, unless their existence can be historically documented. |
| **Alterations and Additions for a New Use** | |
| Retaining the glazing and the transparency (i.e., which allows the openness of the interior to be experienced from the exterior) that is so important in defining the character of a historic storefront when the building is being converted for residential use. Window treatments (necessary for occupants' privacy) should be installed that are uniform and compatible with the commercial appearance of the building, such as screens or wood blinds. When display cases still exist behind the storefront, the screening should be set at the back of the display case. | Replacing storefront glazing with solid material for occupants' privacy when the building is being converted for residential use.<br><br>Installing window treatments in storefront windows that have a residential appearance, which are incompatible with the commercial character of the building.<br><br>Installing window treatments that are not uniform in a series of repetitive storefront windows. |

[29] The rehabilitation of the 1910 Mā'alaea General Store (a), which served the workers' camp at the Wailuku Sugar Company on the Hawaiian island of Maui, included the reconstruction of the original parapet (b).

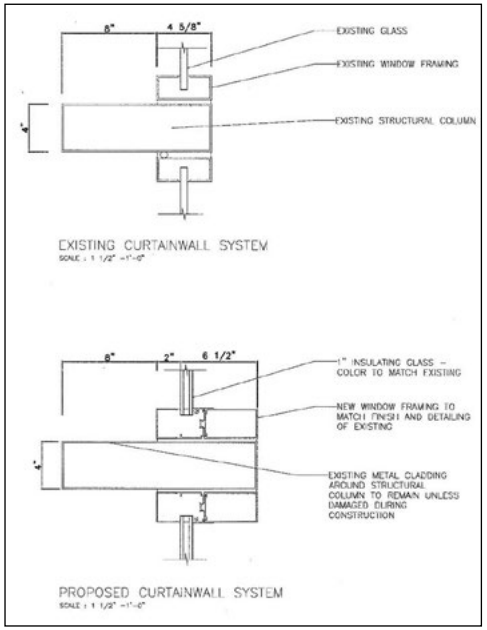
# CURTAIN WALLS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| ***Identifying, retaining, and preserving*** curtain wall systems and their components (metal framing members and glass or opaque panels) that are important in defining the overall historic character of the building. The design of the curtain wall is significant, as are its component materials (metal stick framing and panel materials, such as clear or spandrel glass, stone, terra cotta, metal, and fiber-reinforced plastic), appearance (e.g., glazing color or tint, transparency, and reflectivity), and whether the glazing is fixed, operable or louvered glass panels. How a curtain wall is engineered and fabricated, and the fact that it expands and contracts at a different rate from the building's structural system, are important to understand when undertaking the rehabilitation of a curtain wall system. | Removing or substantially changing curtain wall components which are important in defining the overall historic character of the building so that, as a result, the character is diminished.<br><br>Replacing historic curtain wall features instead of repairing or replacing only the deteriorated components. |
| ***Protecting and maintaining*** curtain walls and their components through appropriate surface treatments, such as cleaning, paint removal, and reapplication of protective coating systems; and by making them watertight and ensuring that sealants and gaskets are in good condition. | Failing to protect and maintain curtain wall components on a cyclical basis so that deterioration of curtain walls results.<br><br>Failing to identify, evaluate, and treat various causes of curtain wall failure, such as open gaps between components where sealants have deteriorated or are missing. |
| Protecting ground-level curtain walls from vandalism before work begins by covering them, while ensuring adequate ventilation, and by installing alarm systems keyed into local protection agencies. | Leaving ground-level curtain walls unprotected and subject to vandalism before work begins, thereby also allowing the interior to be damaged if it can be accessed through unprotected glazing. |
| Protecting curtain walls when working on other features of the building. | Failing to protect curtain walls when working on other features of the building. |
| Cleaning curtain wall systems only when necessary to halt deterioration or to remove heavy soiling. | Cleaning curtain wall systems when they are not heavily soiled, thereby needlessly introducing chemicals or moisture into historic materials. |

## CURTAIN WALLS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Carrying out cleaning tests, when it has been determined that cleaning is appropriate, using only cleaning materials that will not damage components of the system, including factory-applied finishes. Test areas should be examined to ensure that no damage has resulted. | Cleaning curtain wall systems without testing or using cleaning materials that may damage components of the system. |
| Evaluating the overall condition of curtain walls to determine whether more than protection and maintenance, such as repair of curtain wall components, will be necessary. | Failing to undertake adequate measures to protect curtain wall components. |
| ***Repairing*** curtain walls by ensuring that they are watertight by augmenting existing components or replacing deteriorated or missing sealants or gaskets, where necessary, to seal any gaps between system components. Repair may include the limited replacement of those extensively deteriorated or missing components of curtain walls when there are surviving prototypes. | Removing curtain wall components that could be repaired or using improper repair techniques.<br><br>Replacing an entire curtain wall system when repair of materials and limited replacement of deteriorated or missing components are feasible. |
| Applying sealants carefully so that they are not readily visible. | |
| ***Replacing*** in kind a component or components of a curtain wall system that are too deteriorated to repair (if the overall form and detailing are still evident) using the physical evidence as a model to reproduce the feature. If using the same kind of material is not feasible, then a compatible substitute material may be considered as long as it has the same finish and appearance. | Removing a curtain wall component or the entire system, if necessary, that is unrepairable and not replacing it or replacing it with a new component or system that does not convey the same appearance. |
| Replacing masonry, metal, glass, or other components of a curtain wall system (or the entire system, if necessary) which have failed because of faulty design with substitutes that match the original as closely as possible and which will reestablish the viability and performance of the system. | Using substitute material for the replacement that does not convey the same appearance of the surviving components of the curtain wall or that is physically incompatible. |

[30] Rather than replace the original curtain wall system of the 1954 Simms Building in Albuquerque, NM, with a different color tinted glass or coat it with a non-historic reflective film, the HVAC system was updated to improve energy efficiency. *Photo: Harvey M. Kaplan.*




[31 a-c:] (a) The rehabilitation of the First Federal Savings and Loan Association building in Birmingham, AL, constructed in 1961, required replacing the deteriorated historic curtain wall system because the framing and the fasteners holding the spandrel glass and the windows had failed. (b) Comparative drawings show that the differences between the replacement system, which incorporated new insulated glass to meet wind-load requirements, and the original system are minimal. (c) The replacement system, shown after completion of the project, has not altered the historic character of the building.

# CURTAIN WALLS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| *The following work is highlighted to indicate that it is specific to* **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.* | |
| **Designing the Replacement for Missing Historic Features** | |
| Designing and installing a new curtain wall or its components when the historic feature is completely missing. It may be an accurate restoration based on documentary and physical evidence, but only when the historic feature to be replaced coexisted with the features currently on the building. Or, it may be a new design that is compatible with the size, scale, material, and color of the historic building. | Creating an inaccurate appearance because the replacement for the missing curtain wall component is based upon insufficient physical or historic documentation, is not a compatible design, or because the feature did not coexist with the features currently on the building.<br><br>Introducing a new curtain wall component that is incompatible in size, scale, material, color, and finish. |
| **Alterations and Additions for a New Use** | |
| Installing new glazing or an entire new curtain wall system, when necessary to meet safety-code requirements, with dimensions, detailing, materials, colors, and finish as close as possible to the historic curtain wall components. | Installing new glazing or an entire new curtain wall system, when necessary to meet safety-code requirements, with dimensions and detailing that is significantly different from the historic curtain wall components. |
| Installing impact-resistant glazing, when necessary for security, so that it is compatible with the historic windows and does not damage them or negatively impact their character. | Installing impact-resistant glazing in a curtain wall system, when necessary for security, that is incompatible with the historic curtain walls and damages them or negatively impacts their character. |

# STRUCTURAL SYSTEMS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| ***Identifying, retaining, and preserving*** structural systems and visible features of systems that are important in defining the overall historic character of the building. This includes the materials that comprise the structural system (i.e., wood, metal and masonry), the type of system, and its features, such as posts and beams, trusses, summer beams, vigas, cast-iron or masonry columns, above-grade stone foundation walls, or load-bearing masonry walls. | Removing or substantially changing visible features of historic structural systems which are important in defining the overall historic character of the building so that, as a result, the character is diminished.<br><br>Overloading the existing structural system, or installing equipment or mechanical systems which could damage the structure.<br><br>Replacing a load-bearing masonry wall that could be augmented and retained.<br><br>Leaving known structural problems untreated, such as deflected beams, cracked and bowed walls, or racked structural members. |
| ***Protecting and maintaining*** the structural system by keeping gutters and downspouts clear and roofing in good repair; and by ensuring that wood structural members are free from insect infestation. | Failing to protect and maintain the structural system on a cyclical basis so that deterioration of the structural system results.<br><br>Using treatments or products that may retain moisture, which accelerates deterioration of structural members. |

[33] Retaining as much as possible of the historic wood sill plate and replacing only the termite-damaged wood is always the preferred and recommended treatment.

## STRUCTURAL SYSTEMS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Evaluating the overall condition of the structural system to determine whether more than protection and maintenance, such as repairs to structural features, will be necessary. | Failing to undertake adequate measures to ensure the protection of structural systems. |
| ***Repairing*** the structural system by augmenting individual components, using recognized preservation methods. For example, weakened structural members (such as floor framing) can be paired or sistered with a new member, braced, or otherwise supplemented and reinforced. | Upgrading the building structurally in a manner that diminishes the historic character of the exterior or that damages interior features or spaces.<br><br>Replacing a historic structural feature in its entirety or in part when it could be repaired or augmented and retained. |

[32] (a-b) The rehabilitation of the 1892 Carson Block Building in Eureka, CA, for its owner, the Northern California Indian Development Council, included recreating the missing corner turret and sensitively introducing seismic reinforcement (c) shown here (opposite page) in a secondary upper floor office space. *Photos: Page & Turnbull.*

## STRUCTURAL SYSTEMS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Installing seismic or structural reinforcement, when necessary, in a manner that minimizes its impact on the historic fabric and character of the building. | |
| ***Replacing*** in kind or with a compatible substitute material large portions or entire features of the structural system that are either extensively damaged or deteriorated or that are missing when there are surviving prototypes, such as cast-iron columns, trusses, or masonry walls. Substitute material must be structurally sufficient, physically compatible with the rest of the system, and, where visible, must have the same form, design, and appearance as the historic feature. | Using substitute material that does not equal the load-bearing capabilities of the historic material; does not convey the same appearance of the historic material, if it is visible; or is physically incompatible.<br><br>Installing a visible or exposed structural replacement feature that does not match. |
| Replacing to match any interior features or finishes that may have to be removed to gain access to make structural repairs, and reusing salvageable material. | |

## STRUCTURAL SYSTEMS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| *The following work is highlighted to indicate that it is specific to* **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.* | |
| **Alterations and Additions for a New Use** | |
| Limiting any new excavations next to historic foundations to avoid undermining the structural stability of the building or adjacent historic buildings. The area next to the building foundation should be investigated first to ascertain potential damage to site features or archeological resources. | Carrying out excavations or regrading land adjacent to a historic building which could cause the historic foundation to settle, shift, or fail, or which could destroy significant archeological resources. |
| Correcting structural deficiencies needed to accommodate a new use in a manner that preserves the structural system and individual character-defining features. | Making substantial changes to significant interior spaces or damaging or destroying features or finishes that are character defining to correct structural deficiencies. |
| Designing and installing new mechanical or electrical equipment, when necessary, in a manner that minimizes the number and size of cuts or holes in structural members. | Installing new mechanical or electrical equipment in a manner which reduces the load-bearing capacity of historic structural members. |
| Inserting a new floor when required for the new use if it does not negatively impact the historic character of the interior space; and if it does not damage the structural system, does not abut window glazing, and is not visible from the exterior of the building. | Inserting a new floor that damages or destroys the structural system or abuts window glazing and is visible from the exterior of the building and, thus, negatively impacts its historic character. |
| Creating an atrium, light court, or lightwell to provide natural light when required for a new use only when it can be done in a manner that preserves the structural system and the historic character of the building. | Removing structural features to create an atrium, light court, or lightwell if it negatively impacts the historic character of the building. |

## **MECHANICAL SYSTEMS:** HEATING, AIR CONDITIONING, ELECTRICAL, AND PLUMBING

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| ***Identifying, retaining, and preserving*** visible features of early mechanical systems that are important in defining the overall historic character of the building, such as radiators, vents, fans, grilles, and plumbing and lighting fixtures. | Removing or substantially changing visible features of mechanical systems that are important in defining the overall historic character of the building so that, as a result, the character is diminished. |
| ***Protecting and maintaining*** mechanical, plumbing, and electrical systems and their features through cyclical maintenance. | Failing to protect and maintain a functioning mechanical system, plumbing, and electrical systems and their visible features on a cyclical basis so that their deterioration results. |
| Improving the energy efficiency of existing mechanical systems to help reduce the need for a new system by installing storm windows, insulating attics and crawl spaces, or adding awnings, if appropriate. | |
| Evaluating the overall condition of mechanical systems to determine whether more than protection and maintenance, such as repairs to mechanical system components, will be necessary. | Failing to undertake adequate measures to ensure the protection of mechanical system components. |
| ***Repairing*** mechanical systems by augmenting or upgrading system components (such as installing new pipes and ducts), rewiring, or adding new compressors or boilers. | Replacing a mechanical system when its components could be upgraded and retained. |
| ***Replacing*** in kind or with a compatible substitute material those extensively deteriorated or missing visible features of mechanical systems when there are surviving prototypes, such as ceiling fans, radiators, grilles, or plumbing fixtures. | Installing a visible replacement feature of a mechanical system, if it is important in defining the historic character of the building, that does not convey the same appearance. |

## MECHANICAL SYSTEMS: HEATING, AIR CONDITIONING, ELECTRICAL, AND PLUMBING

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| *The following work is highlighted to indicate that it is specific to* **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.* | |
| **Alterations and Additions for a New Use** | |
| Installing a new mechanical system, if required, so that it results in the least alteration possible to the historic building and its character-defining features. | Installing a new mechanical system so that character-defining structural or interior features are radically changed, damaged, or destroyed. |
| Providing adequate structural support for the new mechanical equipment. | Failing to consider the weight and design of new mechanical equipment so that, as a result, historic structural members or finished surfaces are weakened or cracked. |
| Installing new mechanical and electrical systems and ducts, pipes, and cables in closets, service areas, and wall cavities to preserve the historic character of the interior space. | Installing systems and ducts, pipes, and cables in walls or ceilings in a manner that results in extensive loss or damage or otherwise obscures historic building materials and character-defining features. |
| Concealing HVAC ductwork in finished interior spaces, when possible, by installing it in secondary spaces (such as closets, attics, basements, or crawl spaces) or in appropriately-located, furred-down soffits. | Leaving HVAC ductwork exposed in most finished spaces or installing soffits in a location that will negatively impact the historic character of the interior or exterior of the building. |
| Installing exposed ductwork in a finished space when necessary to protect and preserve decorative or other features (such as column capitals, pressed-metal or ornamental plaster ceilings, coffers, or beams) that is painted, and appropriately located so that it will have minimal impact on the historic character of the space. | Installing exposed ductwork in a finished space when necessary to protect and preserve decorative or other features that is not painted, or is located where it will negatively impact the historic character of the space. |
| Lowering ceilings, installing a dropped ceiling, or constructing soffits to conceal ductwork in a finished space when this will not result in extensive loss or damage to historic materials or decorative and other features, and will not change the overall character of the space or the exterior appearance of the building (i.e., lowered ceilings or soffits visible through window glazing). | Lowering ceilings, installing a dropped ceiling, or constructing soffits to conceal ductwork in a finished space in a manner that results in extensive loss or damage to historic materials or decorative and other features, and will change the overall character of the space or the exterior appearance of the building. |

## **MECHANICAL SYSTEMS:** HEATING, AIR CONDITIONING, ELECTRICAL, AND PLUMBING

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Installing appropriately located, exposed ductwork in historically-unfinished interior spaces in industrial or utilitarian buildings. | |
| Installing a split system mechanical unit in a manner that will have minimal impact on the historic character of the interior and result in minimal loss of historic building material. | Installing a split system mechanical unit without considering its impact on the historic character of the interior or the potential loss of historic building material. |
| Installing heating or air conditioning window units only when the installation of any other system would result in significant damage or loss of historic materials or features. | |
| Installing mechanical equipment on the roof, when necessary, so that it is minimally visible to preserve the building's historic character and setting. | Installing mechanical equipment on the roof that is overly large or highly visible and negatively impacts the historic character of the building or setting. |
| Placing air conditioning compressors in a location on a secondary elevation of the historic building that is not highly visible. | Placing air conditioning compressors where they are highly visible and negatively impact the historic character of the building or setting. |

[34] The new ceiling ducts installed during the conversion of this historic office building into apartments are minimal in design and discretely placed above the windows.

## INTERIOR SPACES, FEATURES, AND FINISHES

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| ***Identifying, retaining, and preserving*** a floor plan or interior spaces, features, and finishes that are important in defining the overall historic character of the building. Significant spatial characteristics include the size, configuration, proportion, and relationship of rooms and corridors; the relationship of features to spaces; and the spaces themselves, such as lobbies, lodge halls, entrance halls, parlors, theaters, auditoriums, gymnasiums, and industrial and commercial interiors. Color, texture, and pattern are important characteristics of features and finishes, which can include such elements as columns, plaster walls and ceilings, flooring, trim, fireplaces and mantels, paneling, light fixtures, hardware, decorative radiators, ornamental grilles and registers, windows, doors, and transoms; plaster, paint, wallpaper and wall coverings, and special finishes, such as marbleizing and graining; and utilitarian (painted or unpainted) features, including wood, metal, or concrete exposed columns, beams, and trusses and exposed load-bearing brick, concrete, and wood walls. | Altering a floor plan, or interior spaces (including individual rooms), features, and finishes, which are important in defining the overall historic character of the building so that, as a result, the character is diminished.<br><br>Altering the floor plan by demolishing principal walls and partitions for a new use.<br><br>Altering or destroying significant interior spaces by inserting additional floors or lofts; cutting through floors to create lightwells, light courts, or atriums; lowering ceilings; or adding new walls or removing historic walls.<br><br>Relocating an interior feature, such as a staircase, so that the circulation pattern and the historic relationship between features and spaces are altered.<br><br>Installing new material that obscures or damages character-defining interior features or finishes.<br><br>Removing paint, plaster, or other finishes from historically-finished interior surfaces to create a new appearance (e.g., removing plaster to expose brick walls or a brick chimney breast, stripping paint from wood to stain or varnish it, or removing a plaster ceiling to expose unfinished beams).<br><br>Applying paint, plaster, or other coatings to surfaces that have been unfinished historically, thereby changing their character.<br><br>Changing the type of finish or its color, such as painting a historically-varnished wood feature, or removing paint from a historically-painted feature. |

## INTERIOR SPACES, FEATURES, AND FINISHES

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Retaining decorative or other character-defining features or finishes that typify the showroom or interior of a historic store, such as a pressed-metal ceiling, a beaded-board ceiling, or wainscoting. | Removing decorative or other character-defining features or finishes that typify the showroom or interior of a historic store, such as a pressed-metal ceiling, a beaded-board ceiling, or wainscoting. |
| ***Protecting and maintaining*** historic materials (including plaster, masonry, wood, and metals) which comprise interior spaces through appropriate surface treatments, such as cleaning, paint removal, and reapplication of protective coating systems. | Failing to protect and maintain interior materials and finishes on a cyclical basis so that deterioration of interior features results. |
| Protecting interior features and finishes against arson and vandalism before project work begins by erecting temporary fencing or by covering broken windows and open doorways, while ensuring adequate ventilation, and by installing alarm systems keyed into local protection agencies. | Leaving the building unprotected and subject to vandalism before work begins, thereby allowing the interior to be damaged if it can be accessed through unprotected entrances. |
| Protecting interior features (such as a staircase, mantel, flooring, or decorative finishes) from damage during project work by covering them with plywood, heavy canvas, or plastic sheeting. | Failing to protect interior features and finishes when working on the interior. |

[35] (a) Although deteriorated, the historic school corridor, shown on the left, with its character-defining features, including doors and transoms, was retained and repaired as part of the rehabilitation project (b).


[36] The elaborate features and finishes of this historic banking hall in the Union Trust Company Building, in Cleveland, OH, were retained and repaired as part of its conversion into a food market.

## INTERIOR SPACES, FEATURES, AND FINISHES

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Removing damaged or deteriorated paint and finishes only to the next sound layer using the gentlest method possible prior to repainting or refinishing using compatible paint or other coating systems. | Using potentially damaging methods, such as open-flame torches or abrasive techniques, to remove paint or other coatings.<br><br>Removing paint that is firmly adhered to interior surfaces. |
| Using abrasive cleaning methods only on the interior of industrial or warehouse buildings with utilitarian, unplastered masonry walls and where wood features are not finished, molded, beaded, or worked by hand. Low-pressure abrasive cleaning (e.g., sand-blasting or other media blasting) should only be considered if test patches show no surface damage and after gentler methods have proven ineffective. | Using abrasive methods anywhere but utilitarian and industrial interior spaces or when there are other methods that are less likely to damage the surface of the material. |
| Evaluating the overall condition of the interior materials, features, and finishes to determine whether more than protection and maintenance, such as repairs to features and finishes, will be necessary. | Failing to undertake adequate measures to ensure the protection of interior materials, features, and finishes. |
| ***Repairing*** interior features and finishes by patching, splicing, consolidating, or otherwise reinforcing the materials using recognized preservation methods. Repairs may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated or missing parts of interior features when there are surviving prototypes, such as stairs, balustrades, wood paneling, columns, decorative wall finishes, and ornamental pressed-metal or plaster ceilings. Repairs should be physically and visually compatible. | Removing materials that could be repaired or using improper repair techniques.<br><br>Replacing an entire interior feature (such as a staircase, mantel, or door surround) or a finish (such as a plaster) when repair of materials and limited replacement of deteriorated or missing components are feasible. |

[37] Exposed and painted ducts were appropriately installed here in a retail space in Denver's historic Union Station after considering other options that would have impacted the ceiling height, or damaged or obscured the ornamental plaster crown molding. *Photo: Heritage Consulting Group.*

[39] Leaving the ceiling structure exposed and installing exposed ductwork where it does not impact the windows, are appropriate treatments when rehabilitating an industrial building for another use.

[38] The rehabilitation project retained the industrial character of this historic factory building, which included installation of a fire-rated, clear glass enclosure that allows the stairway, an important interior feature, to remain visible.

## INTERIOR SPACES, FEATURES, AND FINISHES

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| ***Replacing*** in kind an entire interior feature that is too deteriorated to repair (if the overall form and detailing are still evident) using the physical evidence as a model to reproduce the feature. Examples could include wainscoting, window and door surrounds, or stairs. If using the same kind of material is not feasible, then a compatible substitute material may be considered. | Removing a character-defining interior feature that is unrepairable and not replacing it, or replacing it with a new feature or finish that does not match the historic feature.<br><br>Using a substitute material for the replacement that does not convey the same appearance of the interior feature or that is physically incompatible.<br><br>Using a substitute material for the replacement that does not convey the same appearance of the interior feature or that is physically incompatible. |
| *The following work is highlighted to indicate that it is specific to* **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.* | |
| **Designing the Replacement for Missing Historic Features** | |
| Designing and installing a new interior feature or finish when the historic feature or finish is completely missing. This could include missing walls, stairs, mantels, wood trim, and plaster, or even entire rooms if the historic spaces, features, and finishes are missing or have been destroyed by inappropriate alterations. The design may be an accurate restoration based on documentary and physical evidence, but only when the feature or finish to be replaced coexisted with the features currently in the building. Or, it may be a new design that is compatible with the size, scale, material, and color of the historic building. | Creating an inaccurate appearance because the replacement for the missing feature is based upon insufficient physical or historic documentation; is not a compatible design; or because the feature did not coexist with the feature currently on the building.<br><br>Introducing a new interior feature or finish that is incompatible in size, scale, material, color, and finish. |
| **Alterations and Additions for a New Use** | |
| Installing new or additional systems required for a new use for the building, such as bathrooms and mechanical equipment, in secondary spaces to preserve the historic character of the most significant interior spaces. | Subdividing primary spaces, lowering ceilings, or damaging or obscuring character-defining features (such as fireplaces, windows, or stairways) to accommodate a new use for the building. |

## INTERIOR SPACES, FEATURES, AND FINISHES

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Installing new mechanical and electrical systems and ducts, pipes, and cables in closets, service areas, and wall cavities to preserve the historic character of interior spaces, features, and finishes. | Installing ducts, pipes, and cables where they will obscure character-defining features or negatively impact the historic character of the interior. |
| Creating open work areas, when required by the new use, by selectively removing walls only in secondary spaces, less significant upper floors, or other less-visible locations to preserve primary public spaces and circulation systems. | |
| Retaining the configuration of corridors, particularly in buildings with multiple floors with repetitive plans (such as office and apartment buildings or hotels), where not only the floor plan is character defining, but also the width and the length of the corridor, doorways, transoms, trim, and other features, such as wainscoting and glazing. | Making extensive changes to the character of significant historic corridors by narrowing or radically shortening them, or removing their character-defining features. |
| Reusing decorative material or features that had to be removed as part of the rehabilitation work (including baseboards, door casing, paneled doors, and wainscoting) and reusing them in areas where these features are missing or are too deteriorated to repair. | Discarding historic material when it can be reused to replace missing or damaged features elsewhere in the building, or reusing material in a manner that may convey a false sense of history. |
| Installing permanent partitions in secondary, rather than primary, spaces whenever feasible. Removable partitions or partial-height walls that do not destroy the sense of space often may be installed in large character-defining spaces when required by a new use. | Installing partitions that abut windows and glazing or that damage or obscure character-defining spaces, features, or finishes. |
| Enclosing a character-defining interior stairway, when required by code, with fire-rated glass walls or large, hold-open doors so that the stairway remains visible and its historic character is retained. | Enclosing a character-defining interior stairway for safety or functional reasons in a manner that conceals it or destroys its character. |
| Locating new, code-required stairways or elevators in secondary and service areas of the historic building. | Making incompatible changes or damaging or destroying character-defining spaces, features, or finishes when adding new code-required stairways and elevators. |

[41] **Not Recommended**: Leaving fragments of deteriorated or "sculpted" plaster is not a compatible treatment for either finished or unfinished interior spaces.

[40] **Not Recommended:** Removing a finished ceiling and leaving the structure exposed in a historic retail space does not meet the Standards for Rehabilitation.

## INTERIOR SPACES, FEATURES, AND FINISHES

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Creating an atrium, light court, or lightwell to provide natural light when required for a new use only when it can be done in a manner that preserves significant interior spaces, features, and finishes or important exterior elevations. | Destroying or damaging character-defining interior spaces, features, or finishes, or damaging the structural system to create an atrium, light court, or lightwell. |
| Inserting a new floor, mezzanine, or loft when required for a new use if it does not damage or destroy significant interior features and finishes and is not visible from the exterior of the building. | Inserting a new floor, mezzanine, or loft that damages or destroys significant interior features or abuts window glazing and is visible from the exterior of the building, and, thus, negatively impacts its historic character. |
| Inserting a new floor, when necessary for a new use, only in large assembly spaces that are secondary to another assembly space in the building; in a space that has been greatly altered; or where character-defining features have been lost or are too deteriorated to repair. | Inserting a new floor in significant, large assembly spaces with distinctive features and finishes, which negatively impacts their historic character. |
| Installing exposed ductwork in a finished space when necessary to protect and preserve decorative or other features (such as column capitals, ornamental plaster or pressed-metal ceilings, coffers, or beams) that is designed, painted, and appropriately located so that it will have minimal impact on the historic character of the space. | Installing exposed ductwork in a finished space when necessary to protect and preserve decorative or other features that is not painted, or is located where it will negatively impact the historic character of the space. |
| Lowering ceilings, installing a dropped ceiling, or constructing soffits to conceal ductwork in a finished space when they will not result in extensive loss or damage to historic materials or decorative and other features, and will not change the overall character of the space or the exterior appearance of the building (i.e., lowered ceilings or soffits visible through window glazing). | Lowering ceilings, installing a dropped ceiling, or constructing soffits to conceal ductwork in a finished space in a manner that results in extensive loss or damage to historic materials or decorative and other features, and will change the overall character of the space or the exterior appearance of the building. |
| Installing a split system mechanical unit in a manner that will have minimal impact on the historic character of the interior and will result in minimal loss of historic building material. | Installing a split system mechanical unit without considering its impact on the historic character of the interior or the potential loss of historic building material. |

## BUILDING SITE

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| ***Identifying, retaining, and preserving*** features of the building site that are important in defining its overall historic character. Site features may include walls, fences, or steps; circulation systems, such as walks, paths or roads; vegetation, such as trees, shrubs, grass, orchards, hedges, windbreaks, or gardens; landforms, such as hills, terracing, or berms; furnishings and fixtures, such as light posts or benches; decorative elements, such as sculpture, statuary, or monuments; water features, including fountains, streams, pools, lakes, or irrigation ditches; and subsurface archeological resources, other cultural or religious features, or burial grounds which are also important to the site. | Removing or substantially changing buildings and their features or site features which are important in defining the overall historic character of the property so that, as a result, the character is diminished. |

[42] This garden is an important character-defining landscape feature on this college campus.

## BUILDING SITE

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Retaining the historic relationship between buildings and the landscape. | Removing or relocating buildings or landscape features, thereby destroying the historic relationship between buildings and the landscape.<br><br>Removing or relocating buildings on a site or in a complex of related historic structures (such as a mill complex or farm), thereby diminishing the historic character of the site or complex.<br><br>Moving buildings onto the site, thereby creating an inaccurate historic appearance.<br><br>Changing the grade level of the site if it diminishes its historic character. For example, lowering the grade adjacent to a building to maximize use of a basement, which would change the historic appearance of the building and its relation to the site. |
| ***Protecting and maintaining*** buildings and site features by providing proper drainage to ensure that water does not erode foundation walls, drain toward the building, or damage or erode the landscape. | Failing to ensure that site drainage is adequate so that buildings and site features are damaged or destroyed; or, alternatively, changing the site grading so that water does not drain properly. |
| Correcting any existing irrigation that may be wetting the building excessively. | Neglecting to correct any existing irrigation that may be wetting the building excessively. |
| Minimizing disturbance of the terrain around buildings or elsewhere on the site, thereby reducing the possibility of destroying or damaging important landscape features, archeological resources, other cultural or religious features, or burial grounds. | Using heavy machinery or equipment in areas where it may disturb or damage important landscape features, archeological resources, other cultural or religious features, or burial grounds. |
| Surveying and documenting areas where the terrain will be altered to determine the potential impact to important landscape features, archeological resources, other cultural or religious features, or burial grounds. | Failing to survey the building site prior to beginning work, which may result in damage or loss of important landscape features, archeological resources, other cultural or religious features, or burial grounds. |

# BUILDING SITE

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Protecting (e.g., preserving in place) important site features, archeological resources, other cultural or religious features, or burial grounds. | Leaving known site features or archeological material unprotected so that it is damaged during rehabilitation work. |
| Planning and carrying out any necessary investigation before rehabilitation begins, using professional archeologists and methods, when preservation in place is not feasible. | Allowing unqualified personnel to perform data recovery on archeological resources, which can result in damage or loss of important archeological material |
| Preserving important landscape features through regularly-scheduled maintenance of historic plant material. | Allowing important landscape features or archeological resources to be lost, damaged, or to deteriorate due to inadequate protection or lack of maintenance |
| Protecting the building site and landscape features against arson and vandalism before rehabilitation work begins by erecting temporary fencing and by installing alarm systems keyed into local protection agencies. | Leaving the property unprotected and subject to vandalism before work begins so that the building site and landscape features, archeological resources, other cultural or religious features, or burial grounds can be damaged or destroyed.<br><br>Removing or destroying features from the site, such as fencing, paths or walkways, masonry balustrades, or plant material. |
| Installing protective fencing, bollards, and stanchions on a building site, when necessary for security, that are as unobtrusive as possible. | Installing protective fencing, bollards, and stanchions on a building site, when necessary for security, without taking into consideration their location and visibility so that they negatively impact the historic character of the site. |
| Providing continued protection and maintenance of buildings and landscape features on the site through appropriate grounds and landscape management. | Failing to protect and maintain materials and features from the restoration period on a cyclical basis so that deterioration of the site results. |
| Protecting buildings and landscape features when working on the site. | Failing to protect building and landscape features during work on the site or failing to repair damaged or deteriorated site features. |

## BUILDING SITE

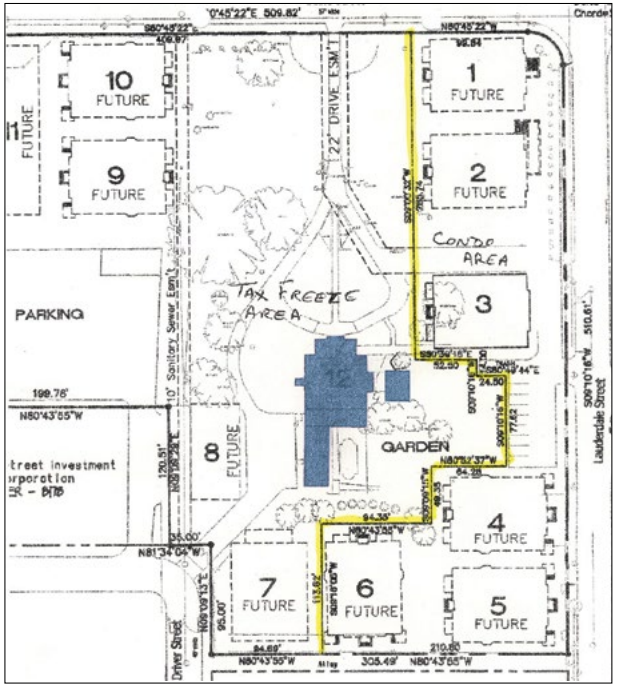
| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Evaluating the overall condition of materials and features to determine whether more than protection and maintenance, such as repairs to site features, will be necessary. | Failing to undertake adequate measures to ensure the protection of the site. |
| ***Repairing*** historic site features which have been damaged, are deteriorated, or have missing components order reestablish the whole feature and to ensure retention of the integrity of the historic materials. Repairs may include limited replacement in kind or with a compatible substitute material of those extensively deteriorated or missing parts of site features when there are surviving prototypes, such as paving, railings, or individual plants within a group (e.g., a hedge). Repairs should be physically and visually compatible. | Removing materials and features that could be repaired or using improper repair techniques.<br><br>Replacing an entire feature of the site (such as a fence, walkway, or drive) when repair of materials and limited replacement of deteriorated or missing components are feasible. |

[43] The industrial character of the site was retained when this brewery complex was rehabilitated for residential use.

[44] **Not Recommended:** (a-b) The historic character of this plantation house (marked in blue on plan on opposite page) and its site was diminished and adversely impacted when multiple new buildings like this (#3 on plan) were constructed on the property (c).

# BUILDING SITE

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| ***Replacing*** in kind an entire feature of the site that is too deteriorated to repair (if the overall form and detailing are still evident) using the physical evidence as a model to reproduce the feature. Examples could include a walkway or a fountain, a land form, or plant material. If using the same kind of material is not feasible, then a compatible substitute material may be considered. | Removing a character-defining feature of the site that is unrepairable and not replacing it, or replacing it with a new feature that does not match.<br><br>Using a substitute material for the replacement that does not convey the same appearance of the surviving site feature or that is physically or ecologically incompatible.<br><br>Adding conjectural landscape features to the site (such as period reproduction light fixtures, fences, fountains, or vegetation) that are historically inappropriate, thereby creating an inaccurate appearance of the site. |




[45] Undertaking a survey to document archeological resources may be considered in some rehabilitation projects when a new exterior addition is planned.

# BUILDING SITE

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| *The following work is highlighted to indicate that it is specific to* **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.* | |
| **Designing the Replacement for Missing Historic Features** | |
| Designing and installing a new feature on a site when the historic feature is completely missing. This could include missing outbuildings, terraces, drives, foundation plantings, specimen trees, and gardens. The design may be an accurate restoration based on documentary and physical evidence, but only when the feature to be replaced coexisted with the features currently on the site. Or, it may be a new design that is compatible with the historic character of the building and site. | Creating an inaccurate appearance because the replacement for the missing feature is based upon insufficient physical or historic documentation, is not a compatible design, or because the feature did not coexist with the features currently on the site.<br><br>Introducing a new feature, including plant material, that is visually incompatible with the site or that alters or destroys the historic site patterns or use. |
| **Alterations and Additions for a New Use** | |
| Designing new onsite features (such as parking areas, access ramps, or lighting), when required by a new use, so that they are as unobtrusive as possible, retain the historic relationship between the building or buildings and the landscape, and are compatible with the historic character of the property. | Locating parking areas directly adjacent to historic buildings where vehicles may cause damage to buildings or landscape features or when they negatively impact the historic character of the building site if landscape features and plant materials are removed. |
| Designing new exterior additions to historic buildings or adjacent new construction that are compatible with the historic character of the site and preserves the historic relationship between the building or buildings and the landscape. | Introducing new construction on the building site which is visually incompatible in terms of size, scale, design, material, or color, which destroys historic relationships on the site, or which damages or destroys important landscape features, such as replacing a lawn with paved parking areas or removing mature trees to widen a driveway. |
| Removing non-significant buildings, additions, or site features which detract from the historic character of the site. | Removing a historic building in a complex of buildings or removing a building feature or a landscape feature which is important in defining the historic character of the site. |
| Locating an irrigation system needed for a new or continuing use of the site where it will not cause damage to historic buildings. | Locating an irrigation system needed for a new or continuing use of the site where it will damage historic buildings. |

## SETTING (DISTRICT / NEIGHBORHOOD)

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| ***Identifying, retaining, and preserving*** building and landscape features that are important in defining the overall historic character of the setting. Such features can include circulation systems, such as roads and streets; furnishings and fixtures, such as light posts or benches; vegetation, gardens and yards; adjacent open space, such as fields, parks, commons, or woodlands; and important views or visual relationships. | Removing or substantially changing those building and landscape features in the setting which are important in defining the historic character so that, as a result, the character is diminished. |

[46] The varied size, shapes, and architectural styles of these historic buildings are unique to this street in Christiansted, St. Croix, USVI, and should be retained in a rehabilitation project.

[47] Original paving stones contribute to the character of the historic setting and distinguish this block from other streets in the district.

[48] Old police and fire call boxes, which are distinctive features in this historic district, have been retained, and now showcase work by local artists.

## SETTING (DISTRICT / NEIGHBORHOOD)

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Retaining the historic relationship between buildings and landscape features in the setting. For example, preserving the relationship between a town common or urban plaza and the adjacent houses, municipal buildings, roads, and landscape and streetscape features. | Altering the relationship between the buildings and landscape features in the setting by widening existing streets, changing landscape materials, or locating new streets or parking areas where they may negatively impact the historic character of the setting.<br><br>Removing or relocating buildings or landscape features, thereby destroying the historic relationship between buildings and the landscape in the setting. |

[49] Low stone walls are character-defining features in this hilly, early-20th-century residential neighborhood.

## SETTING (DISTRICT / NEIGHBORHOOD)

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| ***Protecting and maintaining*** historic features in the setting through regularly-scheduled maintenance and grounds and landscape management. | Failing to protect and maintain materials in the setting on a cyclical basis so that deterioration of buildings and landscape features results.<br><br>Stripping or removing historic features from buildings or the setting, such as a porch, fencing, walkways, or plant material. |
| Installing protective fencing, bollards, and stanchions in the setting, when necessary for security, that are as unobtrusive as possible. | Installing protective fencing, bollards, and stanchions in the setting, when necessary for security, without taking into consideration their location and visibility so that they negatively impact the historic character of the setting. |
| Protecting buildings and landscape features when undertaking work in the setting. | Failing to protect buildings and landscape features during work in the setting. |
| Evaluating the overall condition of materials and features to determine whether more than protection and maintenance, such as repairs to materials and features in the setting, will be necessary. | Failing to undertake adequate measures to ensure the protection of materials and features in the setting. |
| ***Repairing*** features in the setting by reinforcing the historic materials. Repairs may include the replacement in kind or with a compatible substitute material of those extensively deteriorated or missing parts of setting features when there are surviving prototypes, such as fencing, paving materials, trees, and hedgerows. Repairs should be physically and visually compatible. | Failing to repair and reinforce damaged or deteriorated historic materials and features in the setting.<br><br>Removing material that could be repaired or using improper repair techniques.<br><br>Replacing an entire feature of the building or landscape in the setting when repair of materials and limited replacement of deteriorated or missing components are feasible. |

## SETTING (DISTRICT / NEIGHBORHOOD)

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| ***Replacing*** in kind an entire building or landscape feature in the setting that is too deteriorated to repair (if the overall form and detailing are still evident) using the physical evidence as a model to reproduce the feature. If using the same kind of material is not feasible, then a compatible substitute material may be considered. | Removing a character-defining feature of the building or landscape from the setting that is unrepairable and not replacing it or replacing it with a new feature that does not match.<br><br>Using a substitute material for the replacement that does not convey the same appearance of the surviving building or landscape feature in the setting or that is physically or ecologically incompatible. |
| *The following work is highlighted to indicate that it is specific to* **Rehabilitation** *projects and should only be considered after the preservation concerns have been addressed.* | |
| **Designing the Replacement for Missing Historic Features** | |
| Designing and installing a new feature of the building or landscape in the setting when the historic feature is completely missing. This could include missing steps, streetlights, terraces, trees, and fences. The design may be an accurate restoration based on documentary and physical evidence, but only when the feature to be replaced coexisted with the features currently in the setting. Or, it may be a new design that is compatible with the historic character of the setting. | Creating an inaccurate appearance because the replacement for the missing feature is based upon insufficient physical or historic documentation; is not a compatible design, or because the feature did not coexist with the features currently in the setting.<br><br>Introducing a new building or landscape feature that is visually or otherwise incompatible with the setting's historic character (e.g., replacing low metal fencing with a high wood fence). |
| **Alterations and Additions for a New Use** | |
| Designing new features (such as parking areas, access ramps, or lighting), when required by a new use, so that they are as unobtrusive as possible, retain the historic relationships between buildings and the landscape in the setting, and are compatible with the historic character of the setting. | Locating parking areas directly adjacent to historic buildings where vehicles may cause damage to buildings or landscape features or when they negatively impact the historic character of the setting if landscape features and plant materials are removed. |
| Designing new exterior additions to historic buildings or adjacent new construction that are compatible with the historic character of the setting that preserve the historic relationship between the buildings and the landscape. | Introducing new construction into historic districts which is visually incompatible or that destroys historic relationships within the setting, or which damages or destroys important landscape features. |
| Removing non-significant buildings, additions, or landscape features which detract from the historic character of the setting. | Removing a historic building, a building feature, or landscape feature which is important in defining the historic character of the setting. |

## CODE-REQUIRED WORK

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| *Sensitive solutions to meeting accessibility and life-safety code requirements are an important part of protecting the historic character of the building and site. Thus, work that must be done to meet use-specific code requirements should be considered early in planning a* ***Rehabilitation*** *of a historic building for a new use. Because code mandates are directly related to occupancy, some uses require less change than others and, thus, may be more appropriate for a historic building. Early coordination with code enforcement authorities can reduce the impact of alterations necessary to comply with current codes.* | |
| **ACCESSIBILITY** | |
| Identifying the historic building's character-defining exterior features, interior spaces, features, and finishes, and features of the site and setting which may be affected by accessibility code-required work. | Undertaking accessibility code-required alterations before identifying those exterior features, interior spaces, features, and finishes, and features of the site and setting which are character defining and, therefore, must be preserved. |
| Complying with barrier-free access requirements in such a manner that the historic building's character-defining exterior features, interior spaces, features, and finishes, and features of the site and setting are preserved or impacted as little as possible. | Altering, damaging, or destroying character-defining exterior features, interior spaces, features, and finishes, or features of the site and setting while making modifications to a building, its site, or setting to comply with accessibility requirements. |

[50] This kitchen in a historic apartment complex was rehabilitated to meet accessibility requirements.

[51] A new interior access ramp with a simple metal railing is compatible with the character of this mid-century-modern building.

## CODE-REQUIRED WORK

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Working with specialists in accessibility and historic preservation to determine the most sensitive solutions to comply with access requirements in a historic building, its site, or setting. | Making changes to historic buildings, their sites, or setting without first consulting with specialists in accessibility and historic preservation to determine the most appropriate solutions to comply with accessibility requirements. |
| Providing barrier-free access that promotes independence for the user while preserving significant historic features. | Making modifications for accessibility that do not provide independent, safe access while preserving historic features. |
| Finding solutions to meet accessibility requirements that minimize the impact of any necessary alteration on the historic building, its site, and setting, such as compatible ramps, paths, and lifts. | Making modifications for accessibility without considering the impact on the historic building, its site, and setting. |

[52] The access ramp blends in with the stone façade of the First National Bank in Stephenville, TX, and is appropriately located on the side where it is does not impact the historic character of the building. *Photo: Nancy McCoy, QuimbyMcCoy Preservation Architecture, LLP.*


[53] This entrance ramp (right) is compatible with the historic character of this commercial building.

[54] The gently-sloped path in a historic park in Kansas City, MO, which accesses the memorial below, includes a rest area part way up the hill. *Photo: STRATA Architecture + Preservation.*

## CODE-REQUIRED WORK

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Using relevant sections of existing codes regarding accessibility for historic buildings that provide alternative means of code compliance when code-required work would otherwise negatively impact the historic character of the property. | |
| Minimizing the impact of accessibility ramps by installing them on secondary elevations when it does not compromise accessibility or by screening them with plantings. | Installing elevators, lifts, or incompatible ramps at a primary entrance, or relocating primary entrances to secondary locations to provide access without investigating other options or locations. |
| Adding a gradual slope or grade to the sidewalk, if appropriate, to access the entrance rather than installing a ramp that would be more intrusive to the historic character of the building and the district. | |
| Adding an exterior stair or elevator tower that is compatible with the historic character of the building in a minimally-visible location only when it is not possible to accommodate it on the interior without resulting in the loss of significant historic spaces, features, or finishes. | |
| Installing a lift as inconspicuously as possible when it is necessary to locate it on a primary elevation of the historic building. | |
| Installing lifts or elevators on the interior in secondary or less significant spaces where feasible. | Installing lifts or elevators on the interior in primary spaces which will negatively impact the historic character of the space. |

[55] The lift is compatible with the industrial character of this former warehouse.



[56 a-b] In order to continue in its historic use, the door openings of this 1916 Colonial Revival-style fire station had to be widened to accommodate the larger size of modern fire trucks. Although this resulted in some change to the arched door surrounds, it is minimal and does not negatively impact the historic character of the building. (a) Above, before; *Photo: Fire and Emergency Medical Services Department (FEMS), Washington, D.C.;* below, after.

## CODE-REQUIRED WORK

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| **LIFE SAFETY** | |
| Identifying the historic building's character-defining exterior features, interior spaces, features, and finishes, and features of the site and setting which may be affected by life-safety code-required work. | Undertaking life-safety code-required alterations before identifying those exterior features, interior spaces, features, and finishes, and features of the site and setting which are character defining and, therefore, must be preserved. |
| Complying with life-safety codes (including requirements for impact-resistant glazing, security, and seismic retrofit) in such a manner that the historic building's character-defining exterior features, interior spaces, features, and finishes, and features of the site and setting are preserved or impacted as little as possible. | Altering, damaging, or destroying character-defining exterior features, interior spaces, features, and finishes, or features of the site and setting while making modifications to a building, its site, or setting to comply with life-safety code requirements. |
| Removing building materials only after testing has been conducted to identify hazardous materials, and using only the least damaging abatement methods. | Removing building materials without testing first to identify the hazardous materials, or using potentially damaging methods of abatement. |
| Providing workers with appropriate personal equipment for protection from hazards on the worksite. | Removing hazardous or toxic materials without regard for workers' health and safety or environmentally-sensitive disposal of the materials. |
| Working with code officials and historic preservation specialists to investigate systems, methods, or devices to make the building compliant with life-safety codes to ensure that necessary alterations will be compatible with the historic character of the building. | Making life-safety code-required changes to the building without consulting code officials and historic preservation specialists, with the result that alterations negatively impact the historic character of the building. |
| Using relevant sections of existing codes regarding life safety for historic buildings that provide alternative means of code compliance when code-required work would otherwise negatively impact the historic character of the building. | |

[57] Workers wear protective clothing while removing lead paint from metal features.

[59] (a-b) The decorative concrete balcony railings on this 1960s building did not meet life-safety code requirements. They were replaced with new glass railings with a fritted glass pattern matching the original design—a creative solution that satisfies codes, while preserving the historic appearance of the building when viewed from the street (c-d). *Photos: (a, b, d) ERA Architects, Inc.; (c) Nathan Cyprys, photographer*.

## CODE-REQUIRED WORK

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Upgrading historic stairways and elevators to meet life-safety codes so that they are not damaged or otherwise negatively impacted. | Damaging or making inappropriate alterations to historic stairways and elevators or to adjacent features, spaces, or finishes in the process of doing work to meet code requirements. |
| Installing sensitively-designed fire-suppression systems, such as sprinklers, so that historic features and finishes are preserved. | Covering character-defining wood features with fire-retardant sheathing, which results in altering their appearance. |
| Applying fire-retardant coatings when appropriate, such as intumescent paint, to protect steel structural systems. | Using fire-retardant coatings if they will damage or obscure character-defining features. |
| Adding a new stairway or elevator to meet life-safety code requirements in a manner that preserves adjacent character-defining features and spaces. | Altering, damaging, or destroying character-defining spaces, features, or finishes when adding a new code-required stairway or elevator. |
| Using existing openings on secondary or less-visible elevations or, if necessary, creating new openings on secondary or less-visible elevations to accommodate second egress requirements. | Using a primary or other highly-visible elevation to accommodate second egress requirements without investigating other options or locations. |
| Placing a code-required stairway or elevator that cannot be accommodated within the historic building in a new exterior addition located on a secondary or minimally-visible elevation. | Constructing a new addition to accommodate code-required stairs or an elevator on character-defining elevations or where it will obscure, damage, or destroy character-defining features of the building, its site, or setting. |
| Designing a new exterior stairway or elevator tower addition that is compatible with the historic character of the building. | |

[58] Fire doors that retract into the walls have been installed here (not visible in photo) preserve the historic character of this corridor.

# RESILIENCE TO NATURAL HAZARDS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| *Resilience to natural hazards should be addressed as part of the treatment* ***Rehabilitation****. A historic building may have existing characteristics or features that help address or minimize the impacts of natural hazards. These should be used to best advantage and should be taken into consideration early in the planning stages of a rehabilitation project before proposing any new treatments. When new adaptive treatments are needed they should be carried out in a manner that will have the least impact on the historic character of the building, its site, and setting. .* | |
| Identifying the vulnerabilities of the historic property to the impacts of natural hazards (such as wildfires, hurricanes, or tornadoes) using the most current climate information and data available. | Failing to identify and periodically reevaluate the potential vulnerability of the building, its site, and setting to the impacts of natural hazards. |
| Assessing the potential impacts of known vulnerabilities on character-defining features of the building, its site, and setting; and reevaluating and reassessing potential impacts on a regular basis. | |
| Documenting the property and character-defining features as a record and guide for future repair work, should it be necessary, and storing the documentation in a weatherproof location. | Failing to document the historic property and its character-defining features with the result that such information is not available in the future to guide repair or reconstruction work, should it be necessary. |
| Ensuring that historic resources inventories and maps are accurate, up to date, and accessible in times of emergency. | |
| Maintaining the building, its site, and setting in good repair, and regularly monitoring character-defining features. | Failing to regularly monitor and maintain the property and the building systems in good repair. |
| Using and maintaining existing characteristics and features of the historic building, its site, setting, and larger environment (such as shutters for storm protection or a site wall that keeps out flood waters) that may help to avoid or minimize the impacts of natural hazards | Allowing loss, damage, or destruction to occur to the historic building, its site, or setting by failing to evaluate potential future impacts of natural hazards or to plan and implement adaptive measures, if necessary to address possible threats. |
| Undertaking work to prevent or minimize the loss, damage, or destruction of the historic property while retaining and preserving significant features and the overall historic character of the building, its site, and setting. | Carrying out adaptive measures intended to address the impacts of natural hazards that are unnecessarily invasive or will otherwise adversely impact the historic character of the building, its site, or setting. |


[60] In some instances, it may be necessary to elevate a historic building located in a floodplain to protect it. But this treatment is appropriate only if elevating the building will retain its historic character, including its relationship to the site, and its new height will be compatible with surrounding buildings if in a historic district. The house on the right, which has been raised only slightly, has retained its historic character. The house on the left has been raised several feet higher, resulting in a greater impact on the historic character of the house and the district.

## RESILIENCE TO NATURAL HAZARDS

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Ensuring that, when planning work to adapt for natural hazards, all feasible alternatives are considered, and that the options requiring the least alteration are considered first. | |
| Implementing local and regional traditions (such as elevating residential buildings at risk of flooding or reducing flammable vegetation around structures in fire-prone areas) for adapting buildings and sites in response to specific natural hazards, when appropriate. Such traditional methods may be appropriate if they are compatible with the historic character of the building, its site, and setting. | Implementing a treatment traditionally used in another region or one typically used for a different property type or architectural style which is not compatible with the historic character of the property. |
| Using special exemptions and variances when adaptive treatments to protect buildings from known hazards would otherwise negatively impact the historic character of the building, its site, and setting. | |
| Considering adaptive options, whenever possible, that would protect multiple historic resources, if the treatment can be implemented without negatively impacting the historic character of the district, or archeological resources, other cultural or religious features, or burial grounds. | |

### Sustainability

Sustainability is usually a very important and integral part of the treatment **Rehabilitation.** Existing energy-efficient features should be taken into consideration early in the planning stages of a rehabilitation project before proposing any energy improvements. There are numerous treatments that may be used to upgrade a historic building to help it operate more efficiently while retaining its character.

The topic of sustainability is addressed in detail in **The Secretary of the Interior's Standards for Rehabilitation & Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings.**

# NEW EXTERIOR ADDITIONS TO HISTORIC BUILDINGS AND RELATED NEW CONSTRUCTION

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| **New Additions** | |
| Placing functions and services required for a new use (including elevators and stairways) in secondary or non-character-defining interior spaces of the historic building rather than constructing a new addition. | Expanding the size of the historic building by constructing a new addition when requirements for the new use could be met by altering non-character-defining interior spaces. |
| Constructing a new addition on a secondary or non-character-defining elevation and limiting its size and scale in relationship to the historic building. | Constructing a new addition on or adjacent to a primary elevation of the building which negatively impacts the building's historic character. |
| Constructing a new addition that results in the least possible loss of historic materials so that character-defining features are not obscured, damaged, or destroyed. | Attaching a new addition in a manner that obscures, damages, or destroys character-defining features of the historic building. |
| Designing a new addition that is compatible with the historic building. | Designing a new addition that is significantly different and, thus, incompatible with the historic building. |
| Ensuring that the addition is subordinate and secondary to the historic building and is compatible in massing, scale, materials, relationship of solids to voids, and color. | Constructing a new addition that is as large as or larger than the historic building, which visually overwhelms it (i.e., results in the diminution or loss of its historic character). |

## NEW EXTERIOR ADDITIONS TO HISTORIC BUILDINGS AND RELATED NEW CONSTRUCTION

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Using the same forms, materials, and color range of the historic building in a manner that does not duplicate it, but distinguishes the addition from the original building. | Duplicating the exact form, material, style, and detailing of the historic building in a new addition so that the new work appears to be historic. |
| Basing the alignment, rhythm, and size of the window and door openings of the new addition on those of the historic building. | |
| Incorporating a simple, recessed, small-scale hyphen, or connection, to physically and visually separate the addition from the historic building. | |
| Distinguishing the addition from the original building by setting it back from the wall plane of the historic building. | |

[61 a-b] The materials, design, and location at the back of the historic house are important factors in making this a compatible new addition. *Photos: © Maxwell MacKenzie.*

## NEW EXTERIOR ADDITIONS TO HISTORIC BUILDINGS AND RELATED NEW CONSTRUCTION

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Ensuring that the addition is stylistically appropriate for the historic building type (e.g., whether it is residential or institutional). | |
| Considering the design for a new addition in terms of its relationship to the historic building as well as the historic district, neighborhood, and setting. | |

[62] The stair tower at the rear of this commercial building is a compatible new addition.

# NEW EXTERIOR ADDITIONS TO HISTORIC BUILDINGS AND RELATED NEW CONSTRUCTION

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| **Rooftop Additions** | |
| Designing a compatible rooftop addition for a multi-story building, when required for a new use, that is set back at least one full bay from the primary and other highly-visible elevations and that is inconspicuous when viewed from surrounding streets. | Constructing a rooftop addition that is highly visible, which negatively impacts the character of the historic building, its site, setting, or district. |

[ 63] (a) A mockup should be erected to demonstrate the visibility of a proposed rooftop addition and its potential impact on the historic building. Based on review of this mockup (orange marker), it was determined that the rooftop addition would meet the Standards (b). The addition is unobtrusive and blends in with the building behind it.


New addition

## NEW EXTERIOR ADDITIONS TO HISTORIC BUILDINGS AND RELATED NEW CONSTRUCTION

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Limiting a rooftop addition to one story in height to minimize its visibility and its impact on the historic character of the building. | Constructing a highly-visible, multi-story rooftop addition that alters the building's historic character.<br><br>Constructing a rooftop addition on low-rise, one- to three-story historic buildings that is highly visible, overwhelms the building, and negatively impacts the historic district.<br><br>Constructing a rooftop addition with amenities (such as a raised pool deck with plantings, HVAC equipment, or screening) that is highly visible and negatively impacts the historic character of the building. |


[64] **Not Recommended:** It is generally not appropriate to construct a rooftop addition on a low-rise, two- to three-story building such as this, because it negatively affects its historic character.

# NEW EXTERIOR ADDITIONS TO HISTORIC BUILDINGS AND RELATED NEW CONSTRUCTION

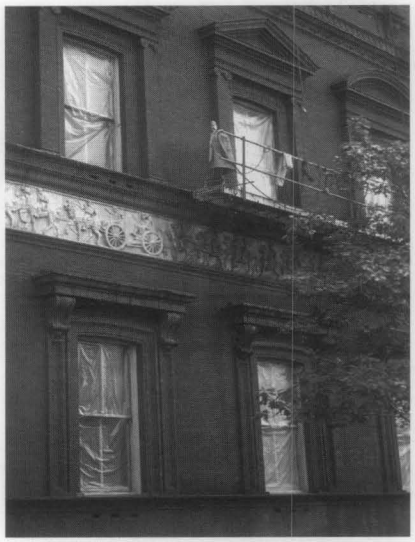
| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| **Related New Construction** | |
| Adding a new building to a historic site or property only if the requirements for a new or continuing use cannot be accommodated within the existing structure or structures. | Adding a new building to a historic site or property when the project requirements could be accommodated within the existing structure or structures. |
| Locating new construction far enough away from the historic building, when possible, where it will be minimally visible and will not negatively affect the building's character, the site, or setting. | Placing new construction too close to the historic building so that it negatively impacts the building's character, the site, or setting. |

[65] (a) This (far left) is a compatible new outbuilding constructed on the site of a historic plantation house (b). Although traditional in design, it is built of wood to differentiate it from the historic house (which is scored stucco) located at the back of the site so as not to impact the historic house, and minimally visible from the public right-of-way (c).

## NEW EXTERIOR ADDITIONS TO HISTORIC BUILDINGS AND RELATED NEW CONSTRUCTION

| RECOMMENDED | NOT RECOMMENDED |
|---|---|
| Designing new construction on a historic site or in a historic setting that it is compatible but differentiated from the historic building or buildings. | Replicating the features of the historic building when designing a new building, with the result that it may be confused as historic or original to the site or setting. |
| Considering the design for related new construction in terms of its relationship to the historic building as well as the historic district and setting. | |
| Ensuring that new construction is secondary to the historic building and does not detract from its significance. | Adding new construction that results in the diminution or loss of the historic character of the building, including its design, materials, location, or setting.<br><br>Constructing a new building on a historic property or on an adjacent site that is much larger than the historic building.<br><br>Designing new buildings or groups of buildings to meet a new use that are not compatible in scale or design with the character of the historic building and the site, such as apartments on a historic school property that are too residential in appearance. |
| Using site features or land formations, such as trees or sloping terrain, to help minimize the new construction and its impact on the historic building and property. | |
| Designing an addition to a historic building in a densely-built location (such as a downtown commercial district) to appear as a separate building or infill, rather than as an addition. In such a setting, the addition or the infill structure must be compatible with the size and scale of the historic building and surrounding buildings—usually the front elevation of the new building should be in the same plane (i.e., not set back from the historic building). This approach may also provide the opportunity for a larger addition or infill when the façade can be broken up into smaller elements that are consistent with the scale of the historic building and surrounding buildings. | |

# 1 PRESERVATION BRIEFS



## Assessing Cleaning and Water-Repellent Treatments for Historic Masonry Buildings

**Robert C. Mack, AIA**
**Anne Grimmer**

U.S. Department of the Interior
National Park Service
Cultural Resources

Heritage Preservation Services

Inappropriate cleaning and coating treatments are a major cause of damage to historic masonry buildings. While either or both treatments may be appropriate in some cases, they can be very destructive to historic masonry if they are not selected carefully. Historic masonry, as considered here, includes stone, brick, architectural terra cotta, cast stone, concrete and concrete block. It is frequently cleaned because cleaning is equated with improvement. Cleaning may sometimes be followed by the application of a water-repellent coating. However, unless these procedures are carried out under the guidance and supervision of an architectural conservator, they may result in irrevocable damage to the historic resource.

The purpose of this Brief is to provide information on the variety of cleaning methods and materials that are available for use on the *exterior* of historic masonry buildings, and to provide guidance in selecting the most appropriate method or combination of methods. The difference between water-repellent coatings and waterproof coatings is explained, and the purpose of each, the suitability of their application to historic masonry buildings, and the possible consequences of their inappropriate use are discussed.

The Brief is intended to help develop sensitivity to the qualities of historic masonry that makes it so special, and to assist historic building owners and property managers in working cooperatively with architects, architectural conservators and contractors (Fig. 1). Although specifically intended for historic buildings, the information is applicable to all masonry buildings. This publication updates and expands *Preservation Brief 1: The Cleaning and Waterproof Coating of Masonry Buildings.* The Brief is not meant to be a cleaning manual or a guide for preparing specifications. Rather, it provides general information to raise awareness of the many factors involved in selecting cleaning and water-repellent treatments for historic masonry buildings.

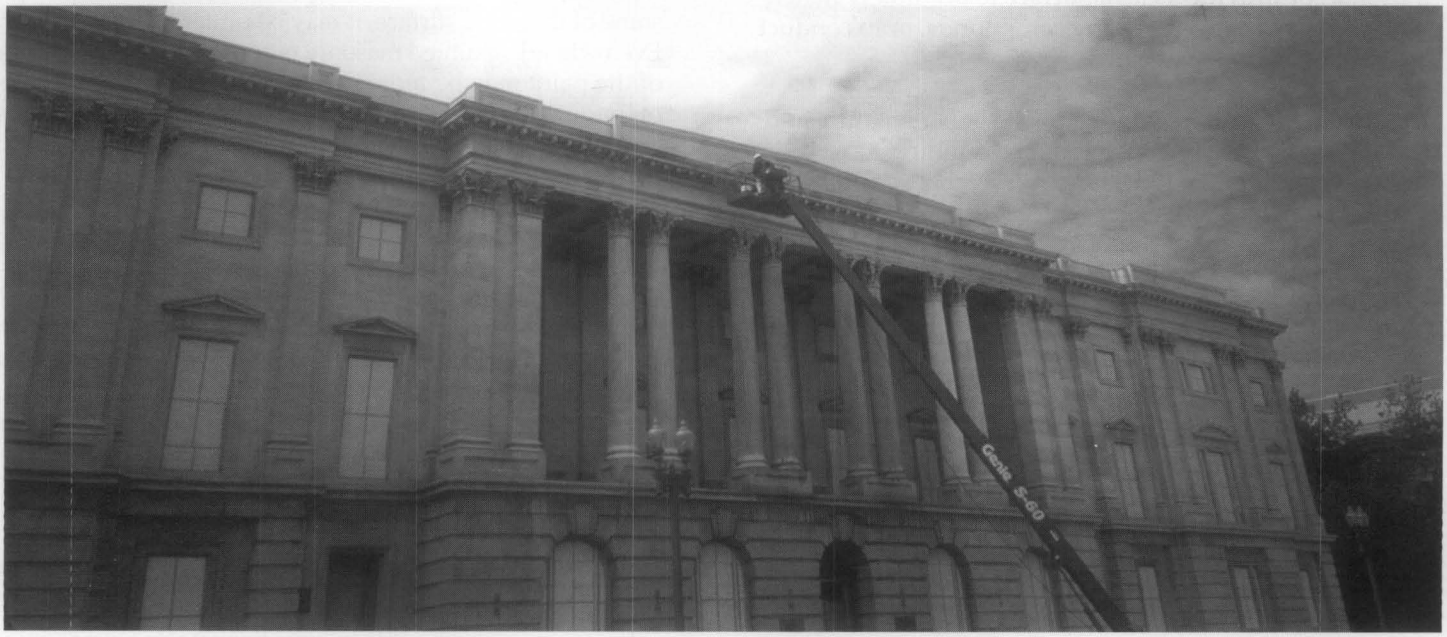



*Figure 1. Low-to medium-pressure steam (hot-pressurized water washing), is being used to clean the exterior of the U.S. Tariff Commission Building, the first marble building constructed in Washington, D.C., in 1839. This method was selected by an architecural conservator as the "gentlest means possible" to clean the marble. Steam can soften heavy soiling deposits such as those on the cornice and column capitals, and facilitate easy removal. Note how these deposits have been removed from the right side of the cornice which has already been cleaned.*

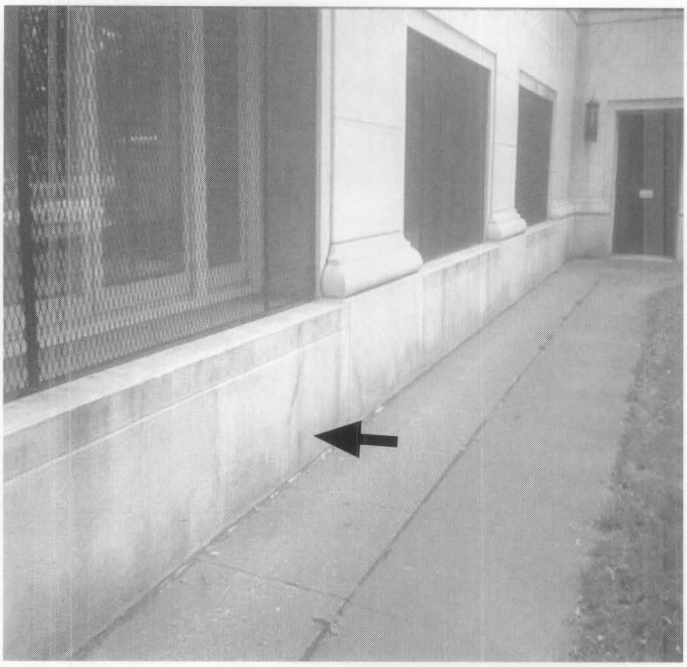


*Figure 2. Biological growth as shown on this marble foundation can usually be removed using a low-pressure water wash, possibly with a non-ionic detergent added to it, and scrubbing with a natural or synthetic bristle brush.*

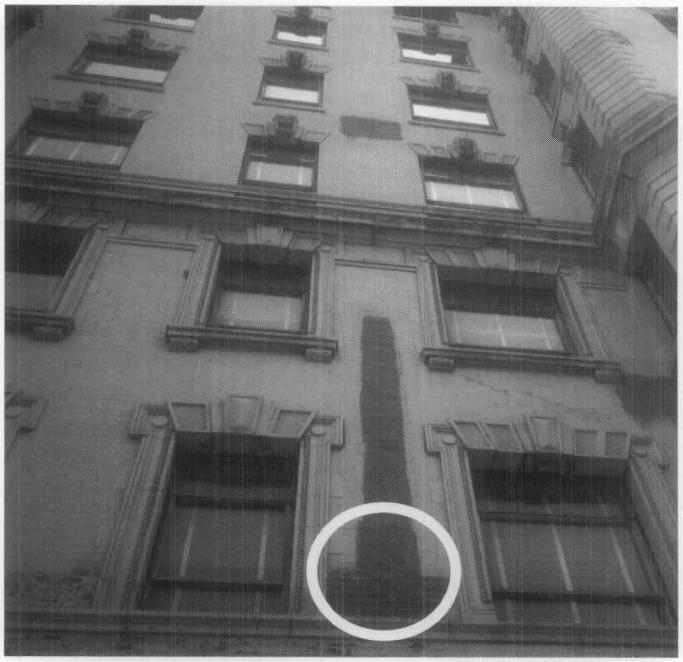


*Figure 3. This small test area has revealed a red brick patch that does not match the original beige brick. This may explain why the building was painted, and may suggest to the owner that it may be preferable to keep it painted.*

## Preparing for a Cleaning Project

**Reasons for cleaning.** First, it is important to determine whether it is appropriate to clean the masonry. The objective of cleaning a historic masonry building must be considered carefully before arriving at a decision to clean. There are several major reasons for cleaning a historic masonry building: **improve the appearance of the building** by removing unattractive dirt or soiling materials, or non-historic paint from the masonry; **retard deterioration** by removing soiling materials that may be damaging the masonry; or **provide a clean surface** to accurately match repointing mortars or patching compounds, or to conduct a condition survey of the masonry.

**Identify what is to be removed.** The general nature and source of dirt or soiling material on a building must be identified to remove it in the *gentlest means possible* — that is, in the most effective, yet least harmful, manner. Soot and smoke, for example, require a different cleaning agent to remove than oil stains or metallic stains. Other common cleaning problems include biological growth such as mold or mildew, and organic matter such as the tendrils left on masonry after removal of ivy (Fig. 2).

**Consider the historic appearance of the building.** If the proposed cleaning is to remove paint, it is important in each case to learn whether or not unpainted masonry is historically appropriate. And, it is necessary to consider why the building was painted (Fig. 3). Was it to cover bad repointing or unmatched repairs? Was the building painted to protect soft brick or to conceal deteriorating stone? Or, was painted masonry simply a fashionable treatment in a particular historic period? Many buildings were painted at the time of construction or shortly thereafter; retention of the paint, therefore, may be more appropriate historically than removing it. And, if the building appears to have been painted for a long time, it is also important to think about whether the paint is part of the character of the historic building and if it has acquired significance over time.

**Consider the practicalities of cleaning or paint removal.** Some gypsum or sulfate crusts may have become integral with the stone and, if cleaning could result in removing some of the stone surface, it may be preferable not to clean. Even where unpainted masonry is appropriate, the retention of the paint may be more practical than removal in terms of long range preservation of the masonry. In some cases, however, removal of the paint may be desirable. For example, the old paint layers may have built up to such an extent that removal is necessary to ensure a sound surface to which the new paint will adhere.

**Study the masonry.** Although not always necessary, in some instances it can be beneficial to have the coating or paint type, color, and layering on the masonry researched before attempting its removal. Analysis of the nature of the soiling or of the paint to be removed from the masonry, as well as guidance on the appropriate cleaning method, may be provided by professional consultants, including architectural conservators, conservation scientists and preservation architects. The State Historic Preservation Office (SHPO), local historic district commissions, architectural review boards and preservation-oriented websites may also be able to supply useful information on masonry cleaning techniques.

## Understanding the Building Materials

The construction of the building must be considered when developing a cleaning program because inappropriate cleaning can have a deleterious effect on the masonry as well as on other building materials. The masonry material or materials must be correctly identified. It is sometimes difficult to distinguish one type of stone from another; for example, certain sandstones can be easily confused with limestones. Or, what appears to be natural stone may not be stone at all, but cast stone or concrete. Historically, cast stone and architectural terra cotta were frequently used in combination with natural stone, especially for trim elements or on upper stories of a building where, from a distance, these substitute materials looked like real stone (Fig. 4). Other features on historic buildings that appear to be stone, such as decorative cornices, entablatures and window hoods, may not even be masonry, but metal.

**Identify prior treatments.** Previous treatments of the building and its surroundings should be researched and building maintenance records should be obtained, if available. Sometimes if streaked or spotty areas do not seem to get cleaner following an initial cleaning, closer inspection and analysis may be warranted. The discoloration may turn out not to be dirt but the remnant of a water-repellent coating applied long ago which has darkened the surface of the masonry over time (Fig. 5). Successful removal may require testing several cleaning agents to find something that will dissolve and remove the coating. Complete removal may not always be possible. Repairs may have been stained to match a dirty building, and cleaning may make these differences apparent. De-icing salts used near the building that have dissolved can migrate into the masonry. Cleaning may draw the salts to the surface, where they will appear as efflorescence (a powdery, white substance), which may require a second treatment to be removed. Allowances for dealing with such unknown factors, any of which can be a potential problem, should be included when investigating cleaning methods and materials. Just as more than one kind of masonry on a historic building may necessitate multiple cleaning approaches, unknown conditions that are encountered may also require additional cleaning treatments.

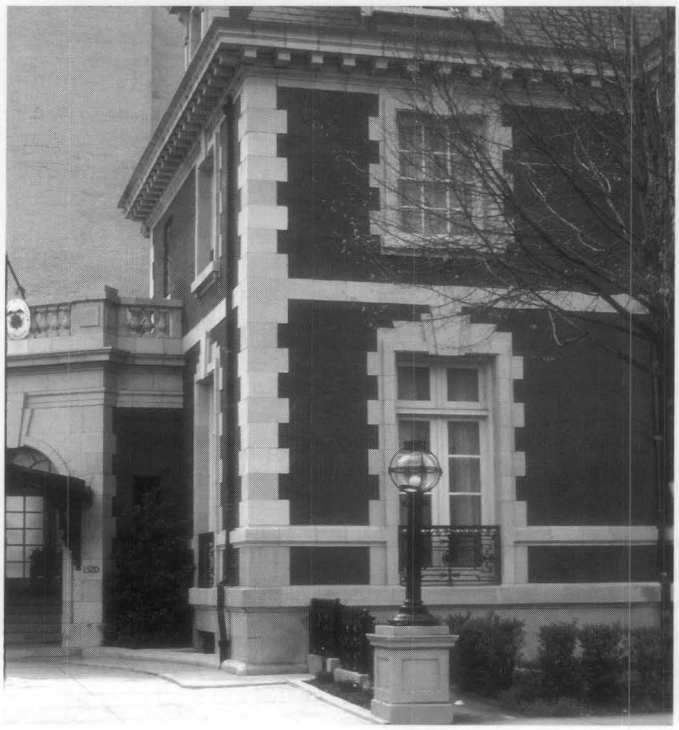


*Figure 4. The foundation of this brick building is limestone, but the decorative trim above is architectural terra cotta intended to simulate stone.*

*Figure 5. Repeated water washing did not remove the staining inside this limestone porte cochere. Upon closer examination, it was determined to be a water-repellent coating that had been applied many years earlier. An alkaline cleaner may be effective in removing it.*

**Choose the appropriate cleaner.** The importance of testing cleaning methods and materials cannot be over emphasized. Applying the wrong cleaning agents to historic masonry can have disastrous results. Acidic cleaners can be extremely damaging to acid-sensitive stones, such as marble and limestone, resulting in etching and dissolution of these stones. Other kinds of masonry can also be damaged by incompatible cleaning agents, or even by cleaning agents that are usually compatible. There are also numerous kinds of sandstone, each with a considerably different geological composition. While an acid-based cleaner may be safely used on some sandstones, others are acid-sensitive and can be severely etched or dissolved by an acid cleaner. Some sandstones contain water-soluble minerals and can be eroded by water cleaning. And, even if the stone type is correctly identified, stones, as well as some bricks, may contain unexpected impurities, such as iron particles, that may react negatively with a particular cleaning agent and result in staining. Thorough understanding of the physical and chemical properties of the masonry will help avoid the inadvertent selection of damaging cleaning agents.

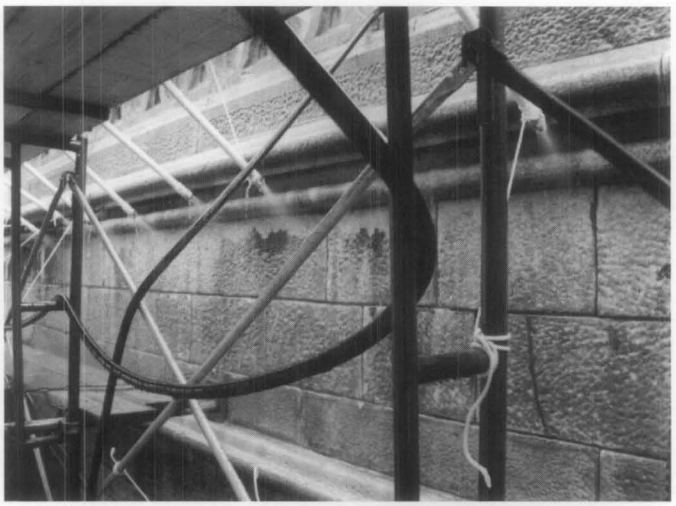


*Figure 6. Timed water soaking can be very effective for cleaning limestone and marble as shown here at the Marble Collegiate Church in New York City. In this case, a twelve-hour water soak using a multi-nozzle manifold was followed by a final water rinse. Photo: Diane S. Kaese, Wiss, Janney, Elstner Associates, Inc., N.Y., N.Y.*

Other building materials also may be affected by the cleaning process. Some chemicals, for example, may have a corrosive effect on paint or glass. The portions of building elements most vulnerable to deterioration may not be visible, such as embedded ends of iron window bars. Other totally unseen items, such as iron cramps or ties which hold the masonry to the structural frame, also may be subject to corrosion from the use of chemicals or even from plain water. The only way to prevent problems in these cases is to study the building construction in detail and evaluate proposed cleaning methods with this information in mind. However, due to the very likely possibility of encountering unknown factors, any cleaning project involving historic masonry should be viewed as unique to that particular building.

## Cleaning Methods and Materials

Masonry cleaning methods generally are divided into three major groups: water, chemical, and abrasive. *Water methods* soften the dirt or soiling material and rinse the deposits from the masonry surface. *Chemical cleaners* react with dirt, soiling material or paint to effect their removal, after which the cleaning effluent is rinsed off the masonry surface with water. *Abrasive methods* include blasting with grit, and the use of grinders and sanding discs, all of which mechanically remove the dirt, soiling material or paint (and, usually, some of the masonry surface). Abrasive cleaning is also often followed with a water rinse. *Laser cleaning*, although not discussed here in detail, is another technique that is used sometimes by conservators to clean small areas of historic masonry. It can be quite effective for cleaning limited areas, but it is expensive and generally not practical for most historic masonry cleaning projects.

Although it may seem contrary to common sense, masonry cleaning projects should be carried out starting at the bottom and proceeding to the top of the building always keeping all surfaces wet below the area being cleaned. The rationale for this approach is based on the principle that dirty water or cleaning effluent dripping from cleaning in progress above will leave streaks on a dirty surface but will not streak a clean surface as long as it is kept wet and rinsed frequently.

### Water Cleaning

Water cleaning methods are generally the *gentlest means possible*, and they can be used safely to remove dirt from all types of historic masonry.* There are essentially four kinds of water-based methods: soaking; pressure water washing; water washing supplemented with non-ionic detergent; and steam, or hot-pressurized water cleaning. Once water cleaning has been completed, it is often necessary to follow up with a water rinse to wash off the loosened soiling material from the masonry.

**Soaking.** Prolonged spraying or misting with water is particularly effective for cleaning limestone and marble. It is also a good method for removing heavy accumulations of soot, sulfate crusts or gypsum crusts that tend to form in protected areas of a building not regularly washed by rain. Water is distributed to lengths of punctured hose or pipe with non-ferrous fittings hung from moveable scaffolding or a swing stage that continuously mists the surface of the masonry with a very fine spray (Fig. 6). A timed on-off spray is another approach to using this cleaning technique. After one area has been cleaned, the apparatus is moved on to another. Soaking is often used in combination with water washing and is also followed by a final water rinse. Soaking is a very slow method — it may take several days or a week—but it is a very gentle method to use on historic masonry.

**Water Washing.** Washing with low-pressure or medium-pressure water is probably one of the most commonly used methods for removing dirt or other pollutant soiling from historic masonry buildings (Fig. 7). Starting with a very low pressure (100 psi or below), even using a garden hose, and progressing as needed to slightly higher pressure —generally no higher than 300-400 psi—is always the recommended way to begin. Scrubbing with natural bristle or synthetic bristle brushes—never metal which can abrade the surface and leave metal particles that can stain the masonry—can help in cleaning areas of the masonry that are especially dirty.

**Water Washing with Detergents.** Non-ionic detergents –which are not the same as soaps –are synthetic organic compounds that are especially effective in removing oily soil. (Examples of some of the numerous proprietary non-ionic detergents include Igepal by GAF, Tergitol by Union Carbide and Triton by Rohm & Haas.) Thus, the addition of a non-ionic detergent, or surfactant, to a low- or medium-pressure water wash can be a useful aid in the cleaning

*Water cleaning methods may not be appropriate to use on some badly deteriorated masonry because water may exacerbate the deterioration, or on gypsum or alabaster which are very soluble in water.

process. (A non-ionic detergent, unlike most household detergents, does not leave a solid, visible residue on the masonry.) Adding a non-ionic detergent and scrubbing with a natural bristle or synthetic bristle brush can facilitate cleaning textured or intricately carved masonry. This should be followed with a final water rinse.

**Steam/Hot-Pressurized Water Cleaning.** Steam cleaning is actually low-pressure hot water washing because the steam condenses almost immediately upon leaving the hose. This is a gentle and effective method for cleaning stone and particularly for acid-sensitive stones. Steam can be especially useful in removing built-up soiling deposits and dried-up plant materials, such as ivy disks and tendrils. It can also be an efficient means of cleaning carved stone details and, because it does not generate a lot of liquid water, it can sometimes be appropriate to use for cleaning interior masonry (Figs. 8-9).

**Potential hazards of water cleaning.** Despite the fact that water-based methods are generally the most gentle, even they can be damaging to historic masonry. Before beginning a water cleaning project, it is important to make sure that all mortar joints are sound and that the building is watertight. Otherwise water can seep through the walls to the interior, resulting in rusting metal anchors and stained and ruined plaster.

Some water supplies may contain traces of iron and copper which may cause masonry to discolor. Adding a chelating or complexing agent to the water, such as EDTA (ethylene diamine tetra-acetic acid), which inactivates other metallic ions, as well as softens minerals and water hardness, will help prevent staining on light-colored masonry.

Any cleaning method involving water should never be done in cold weather or if there is any likelihood of frost or freezing because water within the masonry can freeze, causing spalling and cracking. Since a masonry wall may take over a week to dry after cleaning, no water cleaning should be permitted for several days prior to the first average frost date, or even earlier if local forecasts predict cold weather.

Most essential of all, it is important to be aware that using water at too high a pressure, a practice common to "power washing" and "water blasting", is very abrasive and can easily etch marble and other soft stones, as well as some types of brick (Figs. 10-11). In addition, the distance of the nozzle from the masonry surface and the type of nozzle, as well as gallons per minute (gpm), are also important variables in a water cleaning process that can have a significant impact on the outcome of the project. This is why it is imperative that the cleaning be closely monitored to ensure that the cleaning operators do not raise the pressure or bring the nozzle too close to the masonry in an effort to "speed up" the process. The appearance of grains of stone or sand in the cleaning effluent on the ground is an indication that the water pressure may be too high.

*Figure 7. Glazed architectural terra cotta often may be cleaned successfully with a low-pressure water wash and hand scrubbing supplemented, if necessary, with a non-ionic detergent. Photo: National Park Service Files.*

### Chemical Cleaning

Chemical cleaners, generally in the form of proprietary products, are another material frequently used to clean historic masonry. They can remove dirt, as well as paint and other coatings, metallic and plant stains, and graffiti. Chemical cleaners used to remove dirt and soiling include **acids**, **alkalies** and **organic compounds.** Acidic cleaners, of course, should not be used on masonry that is acid sensitive. Paint removers are **alkaline**, based on **organic solvents** or other chemicals.

### Chemical Cleaners to Remove Dirt

Both alkaline and acidic cleaning treatments include the use of water. Both cleaners are also likely to contain surfactants (wetting agents), that facilitate the chemical reaction that removes the dirt. Generally, the masonry is wet first for both types of cleaners, then the chemical cleaner is sprayed on at very low pressure or brushed onto the surface. The cleaner is left to dwell on the masonry for an amount of time recommended by the product manufacturer or, preferably, determined by testing, and rinsed off with a low- or moderate-pressure cold, or sometimes hot, water wash. More than one application of the cleaner may be necessary, and it is always a good practice to test the product manufacturer's recommendations concerning dilution rates and dwell times. Because each cleaning situation is unique, dilution rates and dwell times can vary considerably. The masonry surface may be scrubbed lightly with natural or synthetic bristle brushes prior to rinsing. After rinsing, pH strips should be applied to the surface to ensure that the masonry has been neutralized completely.

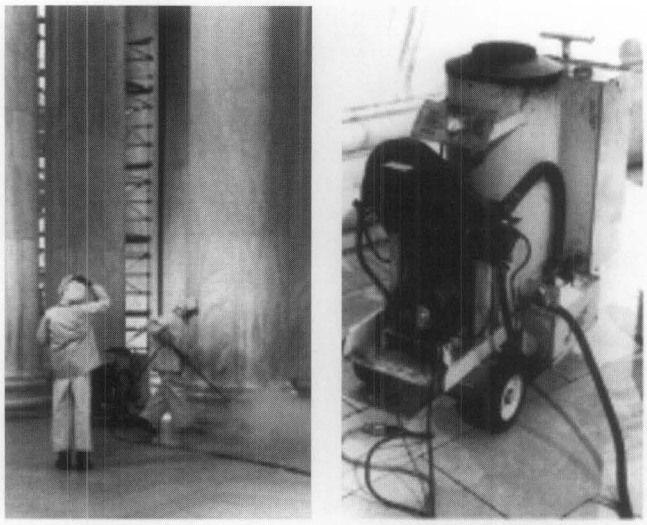


*Figure 8. (Left) Low-pressure (under 100 psi) steam cleaning (hot-pressurized water washing), is part of the regular maintenance program at the Jefferson Memorial, Washington, D.C. The white marble interior of this open structure is subject to constant soiling by birds, insects and visitors. (Right) This portable steam cleaner enables prompt cleanup when necessary. Photos: National Park Service Files.*

**Acidic Cleaners.** Acid-based cleaning products may be used on **non-acid sensitive** masonry, which generally includes: granite, most sandstones, slate, unglazed brick and unglazed architectural terra cotta, cast stone and concrete (Fig. 12). Most commercial acidic cleaners are composed primarily of hydrofluoric acid, and often include some phosphoric acid to prevent rust-like stains from developing on the masonry after the cleaning. Acid cleaners are applied to the pre-wet masonry which should be kept wet while the acid is allowed to "work", and then removed with a water wash.

**Alkaline Cleaners.** Alkaline cleaners should be used on **acid-sensitive** masonry, including: limestone, polished and unpolished marble, calcareous sandstone, glazed brick and glazed architectural terra cotta, and polished granite. (Alkaline cleaners may also be used sometimes on masonry materials that are not acid sensitive—after testing, of course—but they may not be as effective as they are on acid-sensitive masonry.) Alkaline cleaning products consist primarily of two ingredients: a non-ionic detergent or surfactant; and an alkali, such as potassium hydroxide or ammonium hydroxide. Like acidic cleaners, alkaline products are usually applied to pre-wet masonry, allowed to dwell, and then rinsed off with water. (Longer dwell times may be necessary with alkaline cleaners than with acidic cleaners.) Two additional steps are required to remove alkaline cleaners after the initial rinse. First the masonry is given a slightly acidic wash—often with acetic acid–to neutralize it, and then it is rinsed again with water.

**Chemical Cleaners to Remove Paint and Other Coatings, Stains and Graffiti**

Removing paint and some other coatings, stains and graffiti can best be accomplished with alkaline paint removers, organic solvent paint removers, or other cleaning compounds. The removal of layers of paint from a masonry surface usually involves applying the remover either by brush, roller or spraying, followed by a thorough water wash. As with any chemical cleaning, the manufacturer's recommendations regarding application procedures should always be tested before beginning work.

**Alkaline Paint Removers.** These are usually of much the same composition as other alkaline cleaners, containing potassium or ammonium hydroxide, or trisodium phosphate. They are used to remove oil, latex and acrylic paints, and are effective for removing multiple layers of paint. Alkaline cleaners may also remove some acrylic, water-repellent coatings. As with other alkaline cleaners, both an acidic neutralizing wash and a final water rinse are generally required following the use of alkaline paint removers.

**Organic Solvent Paint Removers.** The formulation of organic solvent paint removers varies and may include a combination of solvents, including methylene chloride, methanol, acetone, xylene and toluene.

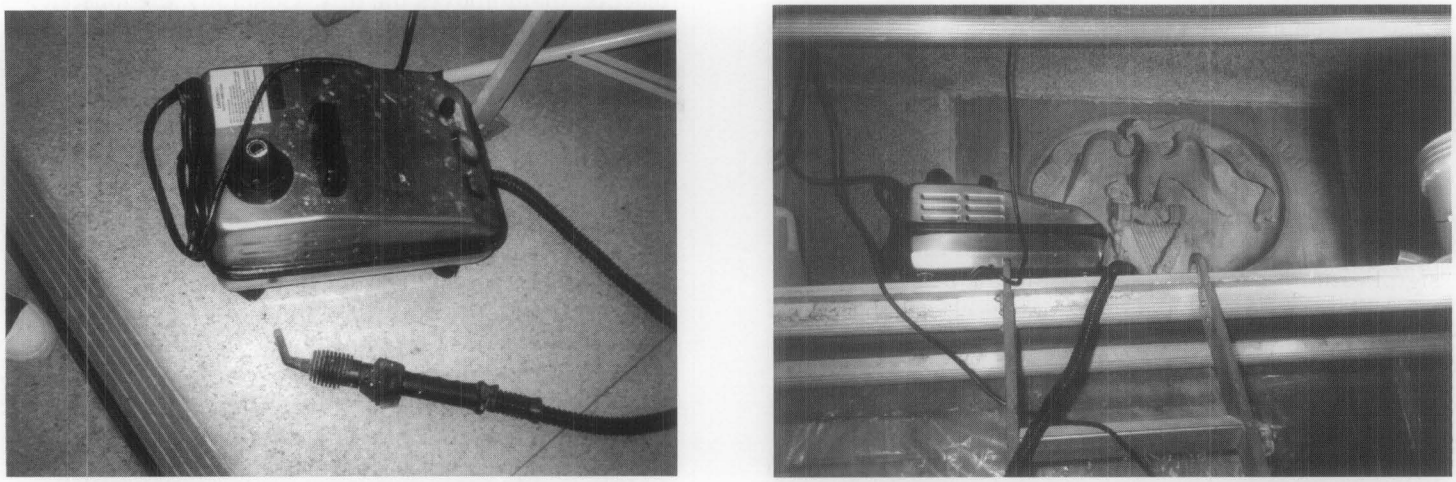


*Figure 9. (Left) This small steam cleaner—the size of a vacuum cleaner—offers a very controlled and gentle means of cleaning limited, or hard-to-reach areas or carved stone details. (Right) It is particularly useful for interiors where it is important to keep moisture to a minumum, such as inside the Washington Monument, Washington, D.C., where it was used to clean the commemorative stones. Photos: Audrey T. Tepper.*

*Figure 10. High-pressure water washing too close to the surface has abraded and, consequently, marred the limestone on this early-20th century building.*

**Other Paint Removers and Cleaners.** Other cleaning compounds that can be used to remove paint and some painted graffiti from historic masonry include paint removers based on N-methyl-2-pyrrolidone (NMP), or on petroleum-based compounds. Removing stains, whether they are industrial (smoke, soot, grease or tar), metallic (iron or copper), or biological (plant and fungal) in origin, depends on carefully matching the type of remover to the type of stain (Fig. 13). Successful removal of stains from historic masonry often requires the application of a number of different removers before the right one is found. The removal of layers of paint from a masonry surface is usually accomplished by applying the remover either by brush, roller or spraying, followed by a thorough water wash (Fig. 14).

**Potential hazards of chemical cleaning.** Since most chemical cleaning methods involve water, they have many of the potential problems of plain water cleaning. Like water methods, they should not be used in cold weather because of the possibility of freezing. Chemical cleaning should never be undertaken in temperatures below 40 degrees F (4 degrees C), and generally not below 50 degrees F. In addition, many chemical cleaners simply do not work in cold temperatures. Both acidic and alkaline cleaners can be dangerous to cleaning operators and, clearly, there are environmental concerns associated with the use of chemical cleaners.

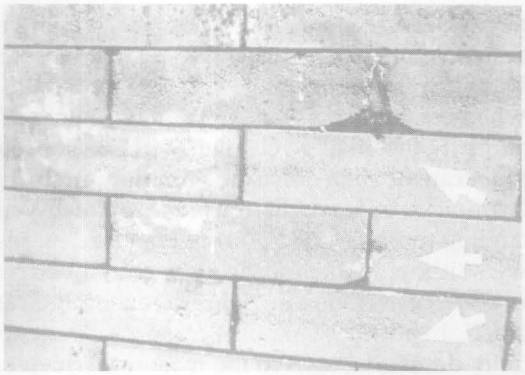


*Figure 11. Rinsing with high-pressure water following chemical cleaning has left a horizontal line of abrasion across the bricks on this late-19th century row house.*

If not carefully chosen, chemical cleaners can react adversely with many types of masonry. Obviously, acidic cleaners should not be used on acid-sensitive materials; however, it is not always clear exactly what the composition is of any stone or other masonry material. For, this reason, testing the cleaner on an inconspicuous spot on the building is always necessary. While certain acid-based cleaners may be appropriate if used as directed on a particular type of masonry, if left too long or if not adequately rinsed from the masonry they can have a negative effect. For example, hydrofluoric acid can etch masonry leaving a hazy residue (whitish deposits of silica or calcium fluoride salts) on the surface. While this efflorescence may usually be removed by a second cleaning—although it is likely to be expensive and time-consuming—**hydrofluoric acid** can also leave calcium fluoride salts or a colloidal silica deposit on masonry which may be impossible to remove (Fig. 15). Other acids, particularly **hydrochloric (muriatic) acid**, which is very powerful, should not be used on historic masonry, because it can dissolve lime-based mortar, damage brick and some stones, and leave chloride deposits on the masonry.

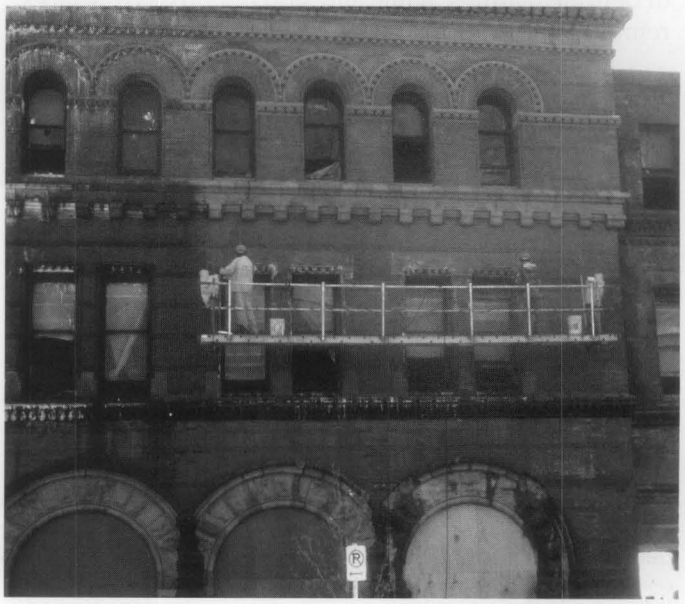


*Figure 12. A mild acidic cleaning agent is being used to clean this heavily soiled brick and granite building. Additional applications of the cleaner and hand-scrubbing, and even poulticing, may be necessary to remove the dark stains on the granite arches below. Photo: Sharon C. Park, FAIA.*

Alkaline cleaners can stain sandstones that contain a ferrous compound. Before using an alkaline cleaner on sandstone it is always important to test it, since it may be difficult to know whether a particular sandstone may contain a ferrous compound. Some alkaline cleaners, such as **sodium hydroxide (caustic soda or lye)** and **ammonium bifluoride**, can also damage or leave disfiguring brownish-yellow stains and, in most cases, should not be used on historic masonry. Although alkaline cleaners will not etch a masonry surface as acids can, they are caustic and can burn the surface. In addition, alkaline cleaners can deposit potentially damaging salts in the masonry which can be difficult to rinse thoroughly.

### Abrasive and Mechanical Cleaning

**Generally, abrasive cleaning methods are not appropriate for use on historic masonry buildings.** Abrasive cleaning methods are just that—abrasive. Grit blasters, grinders, and sanding discs all operate by *abrading* the dirt or paint off the surface of the masonry, rather than *reacting* with the dirt and the masonry which is how water and chemical methods work. Since the abrasives do not differentiate between the dirt and the masonry, they can also remove the outer surface of the masonry at the same time, and result in permanently damaging the masonry. Brick, architectural terra cotta, soft stone, detailed carvings, and polished surfaces are especially susceptible to physical and aesthetic damage by abrasive methods. Brick and architectural terra cotta are fired products which have a smooth, glazed surface which can be removed by abrasive blasting or grinding (Figs. 18-19). Abrasively-cleaned masonry is damaged aesthetically as well as physically, and it has a rough surface which tends to hold dirt and the roughness will make future cleaning more difficult. Abrasive cleaning processes can also increase the likelihood of subsurface cracking of the masonry. Abrasion of carved details causes a rounding of sharp corners and other loss of delicate features, while abrasion of polished surfaces removes the polished finish of stone.

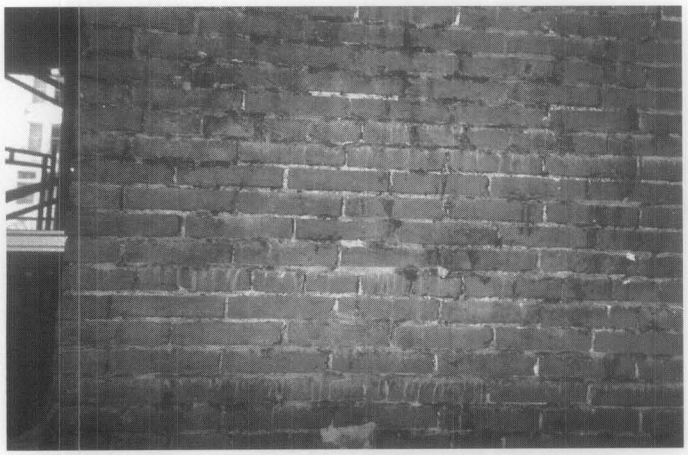


*Figure 13. Sometimes it may be preferable to paint over a thick asphaltic coating rather than try to remove it, because it can be difficult to remove completely. However, in this case, many layers of asphaltic coating were removed through multiple applications of a heavy duty chemical cleaner. Each application of the cleaner was left to dwell following the manufacturer's reccommendations, and then rinsed thoroughly. (As much as possible of the asphalt was first removed with wooden scrapers.) Although not all the asphalt was removed, this was determined to be an acceptable level of cleanliness for the project.*

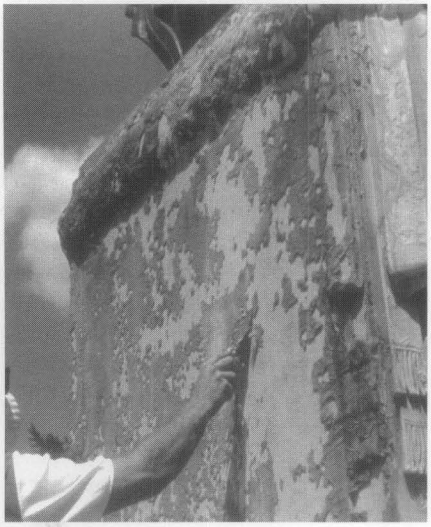
*Figure 14. Chemical removal of paint from this brick building has revealed that the cornice and window hoods are metal rather than masonry.*

Mortar joints, especially those with lime mortar, also can be eroded by abrasive or mechanical cleaning. In some cases, the damage may be visual, such as loss of joint detail or increased joint shadows. As mortar joints constitute a significant portion of the masonry surface (up to 20 per cent in a brick wall), this can result in the loss of a considerable amount of the historic fabric. Erosion of the mortar joints may also permit increased water penetration, which will likely necessitate repointing.

*Figure 15. The whitish deposits left on the brick by a chemical paint remover may have resulted from inadequate rinsing or from the chemical being left on the surface too long and may be impossible to remove.*

## Poulticing to Remove Stains and Graffiti

a



c

d

*Figure 16. (a) The limestone base was heavily stained by runoff from the bronze statue above. (b) A poultice consisting of copper stain remover and ammonia mixed with fuller's earth was applied to the stone base and covered with plastic sheeting to keep it from drying out too quickly. (c) As the poultice dried, it pulled the stain out of the stone. (d) The poultice residue was removed carefully from the stone surface with wooden scrapers and the stone was rinsed with water. Photos: John Dugger.*

b

Graffiti and stains, which have penetrated into the masonry, often are best removed by using a poultice. A poultice consists of an absorbent material or clay powder (such as kaolin or fuller's earth, or even shredded paper or paper towels), mixed with a liquid (solvent or other remover) to form a paste which is applied to the stain (Figs. 16-17). As it dries, the paste absorbs the staining material so that it is not redeposited on the masonry surface. Some commercial cleaning products and paint removers are specially formulated as a paste or gel that will cling to a vertical surface and remain moist for a longer period of time in order to prolong the action of the chemical on the stain. Pre-mixed poultices are also available as a paste or in powder form needing only the addition of the appropriate liquid. The masonry must be pre-wet before applying an alkaline cleaning agent, but not when using a solvent. Once the stain has been removed, the masonry must be rinsed thoroughly.

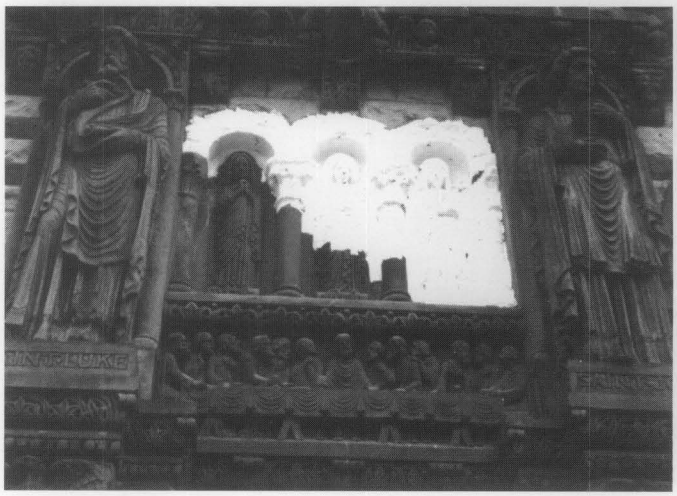


*Figure 17. A poultice is being used to remove salts from the brownstone statuary on the facade of this late-19th century stone church. Photo: National Park Service Files.*

*Figure 18. The glazed bricks in the center of the pier were covered by a signboard that protected them being damaged by the sandblasting which removed the glaze from the surrounding bricks.*

*Figure 19. A comparison of undamaged bricks surroundng the electrical conduit with the rest of the brick facade emphasizes the severity of the erosion caused by sandblasting.*

**Abrasive Blasting.** Blasting with abrasive grit or another abrasive material is the most frequently used abrasive method. *Sandblasting* is most commonly associated with abrasive cleaning. Finely ground silica or glass powder, glass beads, ground garnet, powdered walnut and other ground nut shells, grain hulls, aluminum oxide, plastic particles and even tiny pieces of sponge, are just a few of the other materials that have also been used for abrasive cleaning. Although abrasive blasting is not an appropriate method of cleaning historic masonry, it can be safely used to clean some materials. Finely-powdered walnut shells are commonly used for cleaning monumental bronze sculpture, and skilled conservators clean delicate museum objects and finely detailed, carved stone features with very small, micro-abrasive units using aluminum oxide.

A number of current approaches to abrasive blasting rely on materials that are not usually thought of as abrasive, and not as commonly associated with traditional abrasive grit cleaning. Some patented abrasive cleaning processes—one dry, one wet —use finely-ground glass powder intended to "erase" or remove dirt and surface soiling only, but not paint or stains (Fig. 20). Cleaning with baking soda (sodium bicarbonate) is another patented process. Baking soda blasting is being used in some communities as a means of quick graffiti removal. However, it should not be used on historic masonry which it can easily abrade and can permanently "etch" the graffiti into the stone; it can also leave potentially damaging salts in the stone which cannot be removed. Most of these abrasive grits may be used either dry or wet, although dry grit tends to be used more frequently.

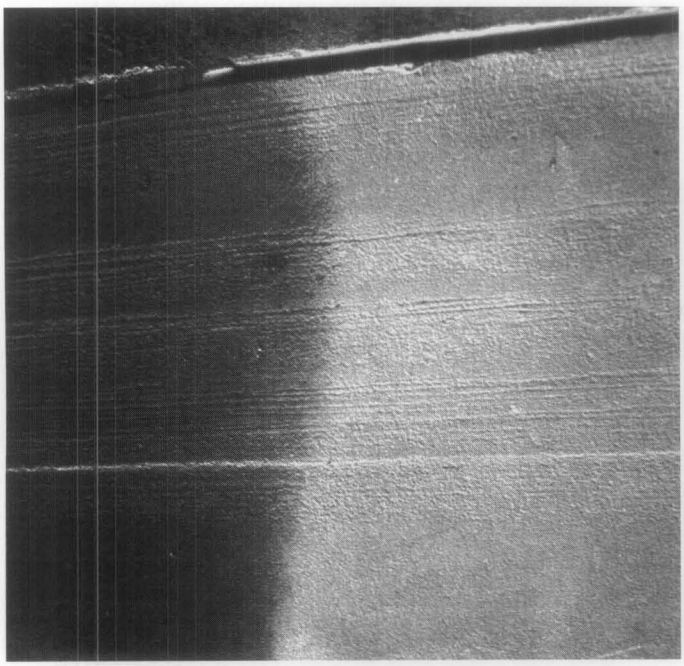


*Figure 20. (Left) A comparison of the limestone surface of a 1920s office building before and after "cleaning" with a proprietary abrasive process using fine glass powder clearly shows the effectiveness of this method. But this is an abrasive technique and it has "cleaned" by removing part of the masonry surface with the dirt. Because it is abrasive, it is generally not recommended for large-scale cleaning of historic masonry, although it may be suitable to use in certain, very limited cases under controlled circumstances. (Right) A vacum chamber where the used glass powder is collected for environmentally safe disposal is a unique feature of this particular process. The specially-trained operators in the chamber wear protective clothing, masks and breathing equipment. Photos: Tom Keohan.*

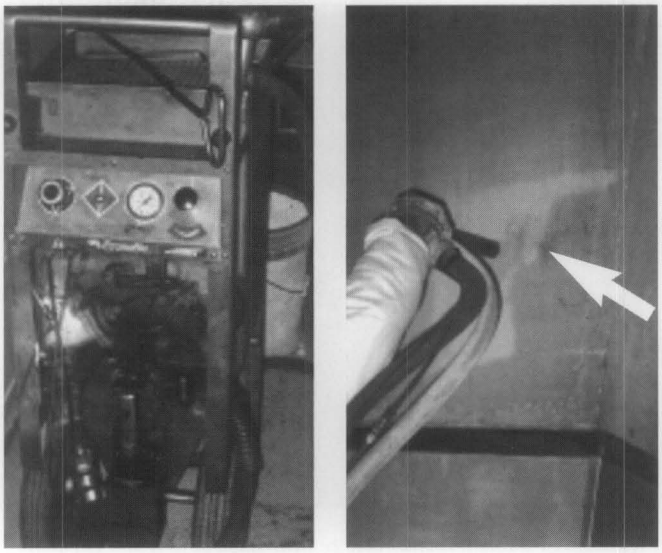


*Figure 21. Low-pressure blasting with ice pellets or ice crystals (left) is an abrasive cleaning method that is sometimes recommended for use on interior masonry because it does not involve large amounts of water. However, like other abrasive materials, ice crystals "clean" by removing a portion of the masonry surface with the dirt, and may not remove some stains that have penetrated into the masonry without causing further abrasion (right). Photos: Audrey T. Tepper.*

Ice particles, or pelletized dry ice (carbon dioxide or $CO_2$), are another medium used as an abrasive cleaner (Fig. 21). This is also too abrasive to be used on most historic masonry, but it may have practical application for removing mastics or asphaltic coatings from some substrates.

Some of these processes are promoted as being more environmentally safe and not damaging to historic masonry buildings. However, it must be remembered that they are abrasive and that they "clean" by removing a small portion of the masonry surface, even though it may be only a minuscule portion. The fact that they are essentially abrasive treatments must always be taken into consideration when planning a masonry cleaning project. *In general, abrasive methods should not be used to clean historic masonry buildings.* In some, very limited instances, highly-controlled, gentle abrasive cleaning may be appropriate on selected, hard-to-clean areas of a historic masonry building if carried out under the watchful supervision of a professional conservator. But, abrasive cleaning should never be used on an entire building.

**Grinders and Sanding Disks.** Grinding the masonry surface with mechanical grinders and sanding disks is another means of abrasive cleaning that should not be used on historic masonry. Like abrasive blasting, grinders and disks do not really clean masonry but instead grind away and abrasively remove and, thus, damage the masonry surface itself rather than remove just the soiling material.

## Planning A Cleaning Project

Once the masonry and soiling material or paint have been identified, and the condition of the masonry has been evaluated, planning for the cleaning project can begin.

**Testing cleaning methods.** In order to determine the *gentlest means possible*, several cleaning methods or materials may have to be tested prior to selecting the best one to use on the building. Testing should always begin with the gentlest and least invasive method proceeding gradually, if necessary, to more complicated methods, or a combination of methods. All too often simple methods, such as low-pressure water wash, are not even considered, yet they frequently are effective, safe, and not expensive. Water of slightly higher pressure or with a non-ionic detergent additive also may be effective. It is worth repeating that these methods should always be tested prior to considering harsher methods; they are safer for the building and the environment, often safer for the applicator, and relatively inexpensive.

The level of cleanliness desired also should be determined prior to selection of a cleaning method. Obviously, the intent of cleaning is to remove most of the dirt, soiling material, stains, paint or other coating. A "brand new" appearance, however, may be inappropriate for an older building, and may require an overly harsh cleaning method to be achieved. When undertaking a cleaning project, it is important to be aware that some stains simply may not be removable. It may be wise, therefore, to agree upon a slightly lower level of cleanliness that will serve as the standard for the cleaning project. The precise amount of residual dirt considered acceptable may depend on the type of masonry, the type of soiling and difficulty of total removal, and local environmental conditions.

Cleaning tests should be carried out in an area of sufficient size to give a true indication of their effectiveness. It is preferable to conduct the test in an inconspicuous location on the building so that it will not be obvious if the test is not successful. A test area may be quite small to begin, sometimes as small as six square inches, and gradually may be increased in size as the most appropriate methods and cleaning agents are determined. Eventually the test area may be expanded to a square yard or more, and it should include several masonry units and mortar joints (Fig. 22). It should be remembered that a single building may have several types of masonry and that even similar materials may have different surface finishes. Each material and different finish should be tested separately. Cleaning tests should be evaluated only after the masonry has dried completely. *The results of the tests may indicate that several methods of cleaning should be used on a single building.*

When feasible, test areas should be allowed to weather for an extended period of time prior to final evaluation. A waiting period of a full year would be ideal in order to expose the test patch to a full range of seasons. If this is not possible, the test patch should weather for at least a month or two. For any building which is considered historically important, the delay is insignificant compared to the potential damage and disfigurement which may result from using an incompletely tested method. *The successfully cleaned test patch should be protected as it will serve as a standard against which the entire cleaning project will be measured.*

**Environmental considerations.** The potential effect of any method proposed for cleaning historic masonry should be evaluated carefully. Chemical cleaners and paint removers may damage trees, shrubs, grass, and plants. A plan must be provided for environmentally safe removal and disposal of the cleaning materials and the rinsing effluent before beginning the cleaning project. Authorities from the local regulatory agency—usually under the jurisdiction of the federal or state Environmental Protection Agency (EPA) should be consulted prior to beginning a cleaning project, especially if it involves anything more than plain water washing. This advance planning will ensure that the cleaning effluent or run-off, which is the combination of the cleaning agent and the substance removed from the masonry, is handled and disposed of in an environmentally sound and legal manner. Some alkaline and acidic cleaners can be neutralized so that they can be safely discharged into storm sewers. However, most solvent-based cleaners cannot be neutralized and are categorized as pollutants, and must be disposed of by a licensed transport, storage and disposal facility. Thus, it is always advisable to consult with the appropriate agencies before starting to clean to ensure that the project progresses smoothly and is not interrupted by a stop-work order because a required permit was not obtained in advance.

Vinyl guttering or polyethylene-lined troughs placed around the perimeter of the base of the building can serve to catch chemical cleaning waste as it is rinsed off the building. This will reduce the amount of chemicals entering and polluting the soil, and also will keep the cleaning waste contained until it can be removed safely. Some patented cleaning systems have developed special equipment to facilitate the containment and later disposal of cleaning waste.

Concern over the release of volatile organic compounds (VOCs) into the air has resulted in the manufacture of new, more environmentally responsible cleaners and paint removers, while some materials traditionally used in cleaning may no longer be available for these same reasons. Other health and safety concerns have created additional cleaning challenges, such as lead paint removal, which is likely to require special removal and disposal techniques.

Cleaning can also cause damage to non-masonry materials on a building, including glass, metal and wood. Thus, it is usually necessary to cover windows and doors, and other features that may be vulnerable to chemical cleaners. They should be covered with plastic or polyethylene, or a masking agent that is applied as a liquid which dries to form a thin protective film on glass, and is easily peeled off after the cleaning is finished. Wind drift, for example, can also damage other property by carrying cleaning chemicals onto nearby automobiles, resulting in etching of the glass or spotting of the paint finish. Similarly, airborne dust can enter surrounding buildings, and excess water can collect in nearby yards and basements.

**Safety considerations.** Possible health dangers of each method selected for the cleaning project must be considered before selecting a cleaning method to avoid harm to the

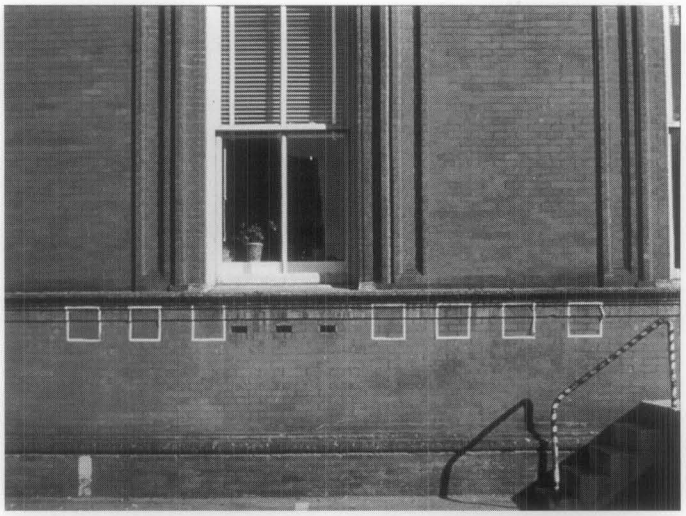


*Figure 22. Cleaning test areas may be quite small at first and gradually increase in size as testing determines the "gentlest means possible". Photo: Frances Gale.*

cleaning applicators, and the necessary precautions must be taken. The precautions listed in Material Safety Data Sheets (MSDS) that are provided with chemical products should always be followed. Protective clothing, respirators, hearing and face shields, and gloves must be provided to workers to be worn at all times. Acidic and alkaline chemical cleaners in both liquid and vapor forms can also cause serious injury to passers-by (Fig. 23). It may be necessary to schedule cleaning at night or weekends if the building is located in a busy urban area to reduce the potential danger of chemical overspray to pedestrians. Cleaning during non-business hours will allow HVAC systems to be turned off and vents to be covered to prevent dangerous chemical fumes from entering the building which will also ensure the safety of the building's occupants. Abrasive and mechanical methods produce dust which can pose a serious health hazard, particularly if the abrasive or the masonry contains silica.

## Water-Repellent Coatings and Waterproof Coatings

To begin with, it is important to understand that waterproof coatings and water-repellent coatings are not the same. Although these terms are frequently interchanged and commonly confused with one another, they are completely different materials. **Water-repellent coatings** —often referred to incorrectly as "sealers", but which do not or should not seal— are intended to keep liquid water from penetrating the surface but to allow water vapor to enter and leave, or pass through, the surface of the masonry (Fig. 24). Water-repellent coatings are generally *transparent*, or clear, although once applied some may darken or discolor certain types of masonry while others may give it a glossy or shiny appearance. **Waterproof coatings** seal the surface from liquid water and from water vapor. They are usually *opaque*, or pigmented, and include bituminous coatings and some elastomeric paints and coatings.

### Water-Repellent Coatings

Water-repellent coatings are formulated to be vapor permeable, or "breathable". They do not seal the surface completely to water vapor so it can enter the masonry wall as well as leave the wall. While the first water-repellent coatings to be developed were primarily acrylic or silicone resins in organic solvents, now most water-repellent coatings are water-based and formulated from modified siloxanes, silanes and other alkoxysilanes, or metallic stearates. While some of these products are shipped from the factory ready to use, other waterborne water repellents must be diluted at the job site. Unlike earlier water-repellent coatings which tended to form a "film" on the masonry surface, modern water-repellent coatings actually penetrate into the masonry substrate slightly and, generally, are almost invisible if properly applied to the masonry. They are also more vapor permeable than the old coatings, yet they still reduce the vapor permeability of the masonry. Once inside the wall, water vapor can condense at cold spots producing liquid water which, unlike water vapor, cannot escape through a water-repellent coating. The liquid water within the wall, whether from condensation, leaking gutters, or other sources, can cause considerable damage.

Water-repellent coatings are not consolidants. Although modern water repellents may penetrate slightly beneath the masonry surface, instead of just "sitting" on top of it, they do not perform the same function as a consolidant which is to "consolidate" and replace lost binder to strengthen deteriorating masonry. Even after many years of laboratory study and testing few consolidants have proven very effective. The composition of fired products such as brick and architectural terra cotta, as well as many types of building stone, does not lend itself to consolidation.

Some modern water-repellent coatings which contain a binder intended to replace the natural binders in stone that have been lost through weathering and natural erosion are described in product literature as both a water repellent and a consolidant. The fact that newer water-repellent coatings penetrate beneath the masonry surface instead of just forming a layer on top of the surface may indeed convey at least some consolidating properties to certain stones. However, a water-repellent coating cannot be considered a consolidant. In some instances, a water-repellent or "preservative" coating, if applied to already damaged or spalling stone, may form a surface crust which, if it fails, may exacerbate the deterioration by pulling off even more of the stone (Fig. 25).

### Is a Water-Repellent Treatment Necessary?

Water-repellent coatings are frequently applied to historic masonry buildings for the wrong reason. They also are often applied without an understanding of what they are and what they are intended to do. And these coatings can be very difficult, if not impossible, to remove from the masonry if they fail or become discolored. Most importantly, the application of water-repellent coatings to historic masonry is usually unnecessary.

*Figure 23. A tarpaulin protects and shields pedestrians from potentially harmful spray while chemical cleaning is underway on the granite exterior of the U.S. Treasury Building, Washington, D.C.*

Most historic masonry buildings, unless they are painted, have survived for decades without a water-repellent coating and, thus, probably do not need one now. Water penetration to the interior of a masonry building is seldom due to porous masonry, but results from poor or deferred maintenance. Leaking roofs, clogged or deteriorated gutters and downspouts, missing mortar, or cracks and open joints around door and window openings are almost always the cause of moisture-related problems in a historic masonry building. **If historic masonry buildings are kept watertight and in good repair, water-repellent coatings should not be necessary.**

Rising damp (capillary moisture pulled up from the ground), or condensation can also be a source of excess moisture in masonry buildings. A water-repellent coating will not solve this problem either and, in fact, may be likely to exacerbate it. Furthermore, a water-repellent coating should never be applied to a damp wall. Moisture in the wall would reduce the ability of a coating to adhere to the masonry and to penetrate below the surface. But, if it did adhere, it would hold the moisture inside the masonry because, although a water-repellent coating is permeable to water vapor, liquid water cannot pass through it. In the case of rising damp, a coating may force the moisture to go even higher in the wall because it can slow down evaporation, and thereby retain the moisture in the wall.

Excessive moisture in masonry walls may carry waterborne soluble salts from the masonry units themselves or from the mortar through the walls. If the water is permitted to come to the surface, the salts may appear on the masonry surface as efflorescence (a whitish powder) upon evaporation. However, the salts can be potentially dangerous if they remain in the masonry and crystallize

*Figure 24. Although the application of a water-repellent coating was probably not needed on either of these buildings, the coating on the brick building (above), is not visible and has not changed the character of the brick. But the coating on the brick column (below), has a high gloss that is incompatible with the historic character of the masonry.*

beneath the surface as subflorescence. Subflorescence eventually may cause the surface of the masonry to spall, particularly if a water-repellent coating has been applied which tends to reduce the flow of moisture out from the subsurface of the masonry. Although many of the newer water-repellent products are more breathable than their predecessors, they can be especially damaging if applied to masonry that contains salts, because they limit the flow of moisture through masonry.

**When a Water-Repellent Coating May be Appropriate**

There are some instances when a water-repellent coating may be considered appropriate to use on a historic masonry building. Soft, incompletely fired brick from the 18th- and early-19th centuries may have become so porous that paint or some type of coating is needed to protect it from further deterioration or dissolution. When a masonry building has been neglected for a long period of time, necessary repairs may be required in order to make it watertight. If, following a reasonable period of time after the building has been made watertight and has dried out completely, moisture appears actually to be penetrating through the repointed and repaired masonry walls, then the application of a water-repellent coating may be considered *in selected areas only*. This decision should be made in consultation with an architectural conservator. And, if such a treatment is undertaken, it should not be applied to the entire exterior of the building.

Anti-graffiti or barrier coatings are another type of clear coating—although barrier coatings can also be pigmented—that may be applied to exterior masonry, but they are not formulated primarily as water repellents. The purpose of these coatings is to make it harder for graffiti to stick to a masonry surface and, thus, easier to clean. But, like water-repellent coatings, in most cases the application of anti-graffiti coatings is generally not recommended for historic masonry buildings. These coatings are often quite shiny which can greatly alter the appearance of a historic masonry surface, and they are not always effective (Fig. 26). Generally, other ways of discouraging graffiti, such as improved lighting, can be more effective than a coating. However, the application of anti-graffiti coatings may be appropriate in some instances on vulnerable areas of historic masonry buildings which are frequent targets of graffiti that are located in out-of-the-way places where constant surveillance is not possible.

Some water-repellent coatings are recommended by product manufacturers as a means of keeping dirt and pollutants or biological growth from collecting on the surface of masonry buildings and, thus, reducing the need for frequent cleaning. While this at times may be true, in some cases a coating may actually retain dirt more than uncoated masonry. Generally, the application of a water-repellent coating is not recommended on a historic masonry building as a means of preventing biological growth. Some water-repellent coatings may actually encourage biological growth on a masonry wall. Biological growth on masonry buildings has traditionally been kept at bay through regularly-scheduled cleaning as part of a maintenance plan. Simple cleaning of the masonry with low-pressure water using a natural- or synthetic-bristled scrub brush can be very effective if done on a regular basis. Commercial products are also available which can be sprayed on masonry to remove biological growth.

**In most instances, a water-repellent coating is not necessary if a building is watertight.** The application of a water-repellent coating is not a recommended treatment for historic masonry buildings unless there is a specific

*Figure 25. The clear coating applied to this limestone molding has failed and is taking off some of the stone surface as it peels. Photo: Frances Gale.*

problem which it may help solve. If the problem occurs on only part of the building, it is best to treat only that area rather than an entire building. Extreme exposures such as parapets, for example, or portions of the building subject to driving rain can be treated more effectively and less expensively than the entire building. Water-repellent coatings are not permanent and must be reapplied periodically although, if they are truly invisible, it can be difficult to know when they are no longer providing the intended protection.

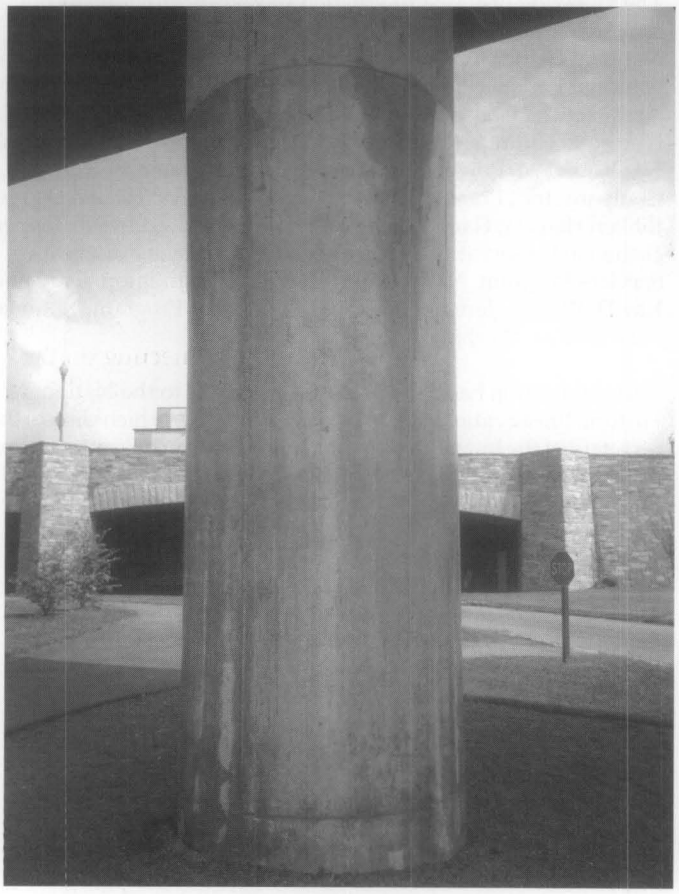


*Figure 26. The anti-graffiti or barrier coating on this column is very shiny and would not be appropriate to use on a historic masonry building. The coating has discolored as it has aged and whitish streaks reveal areas of bare concrete where the coating was incompletely applied.*

Testing a water-repellent coating by applying it in one small area may not be helpful in determining its suitability for the building because a limited test area does not allow an adequate evaluation of such a treatment. Since water may enter and leave through the surrounding untreated areas, there is no way to tell if the coated test area is "breathable." But trying a coating in a small area may help to determine whether the coating is visible on the surface or if it will otherwise change the appearance of the masonry.

**Waterproof Coatings**

In theory, waterproof coatings usually do not cause problems as long as they exclude all water from the masonry. If water does enter the wall from the ground or from the inside of a building, the coating can intensify the damage because the water will not be able to escape. During cold weather this water in the wall can freeze causing serious mechanical disruption, such as spalling.

In addition, the water eventually will get out by the path of least resistance. If this path is toward the interior, damage to interior finishes can result; if it is toward the exterior, it can lead to damage to the masonry caused by built-up water pressure (Fig. 27).

**In most instances, waterproof coatings should not be applied to historic masonry.** The possible exception to this might be the application of a waterproof coating to below-grade exterior foundation walls as a last resort to stop water infiltration on interior basement walls. **Generally, however, waterproof coatings, which include *elastomeric paints*, should almost never be applied above grade to historic masonry buildings.**

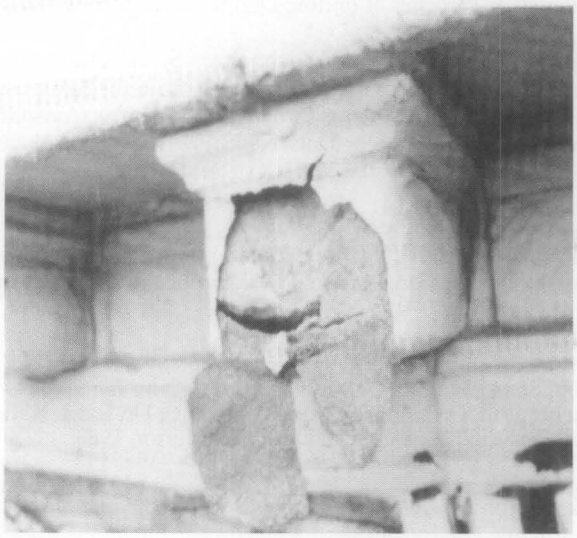


*Figure 27. Instead of correcting the roof drainage problems, an elastomeric coating was applied to the already saturated limestone cornice. An elastomeric coating holds moisture in the masonry because it does not "breathe" and does not allow liquid moisture to escape. If the water pressure builds up sufficiently it can cause the coating to break and pop off as shown in this example, often pulling pieces of the masonry with it. Photo: National Park Service Files.*

## Summary

A well-planned cleaning project is an essential step in preserving, rehabilitating or restoring a historic masonry building. Proper cleaning methods and coating treatments, when determined necessary for the preservation of the masonry, can enhance the aesthetic character as well as the structural stability of a historic building. Removing years of accumulated dirt, pollutant crusts, stains, graffiti or paint, if done with appropriate caution, can extend the life and longevity of the historic resource. Cleaning that is carelessly or insensitively prescribed or carried out by inexperienced workers can have the opposite of the intended effect. It may scar the masonry permanently, and may actually result in hastening deterioration by introducing harmful residual chemicals and salts into the masonry or causing surface loss. Using the wrong cleaning method or using the right method incorrectly, applying the wrong kind of coating or applying a coating that is not needed can result in serious damage, both physically and aesthetically, to a historic masonry building. Cleaning a historic masonry building should always be done using the *gentlest means possible* that will clean, but not damage the building. It should always be taken into consideration before applying a water-repellent coating or a waterproof coating to a historic masonry building whether it is really necessary and whether it is in the best interest of preserving the building.

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## Acknowledgments

**Robert C. Mack, FAIA**, is a principal in the firm of MacDonald & Mack Architects, Ltd., an architectural firm that specializes in historic buildings in Minneapolis, Minnesota.
**Anne Grimmer** is a Senior Architectural Historian in the Technical Preservation Services Branch, Heritage Preservation Services Program, National Park Service, Washington, D.C.

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This publication has been prepared pursuant to the National Historic Preservation Act of 1966, as amended, which directs the Secretary of the Interior to develop and make available information concerning historic properties. Comments on the usefulness of this publication may be directed to: Sharon C. Park, FAIA, Chief, Technical Preservation Services Branch, Heritage Preservation Services Program, National Park Service, 1849 C Street, N.W., Suite NC200, Washington, D.C. 20240 (www2.cr.nps.gov/tps).


*Front Cover: Chemical cleaning of the brick and architectural terra cotta frieze on the 1880s Pension Building, Washington, D.C. (now the National Building Museum), is shown here in progress. Photo: Christina Henry.*

*Photographs used to illustrate this Brief were taken by Anne Grimmer unless otherwise credited.*

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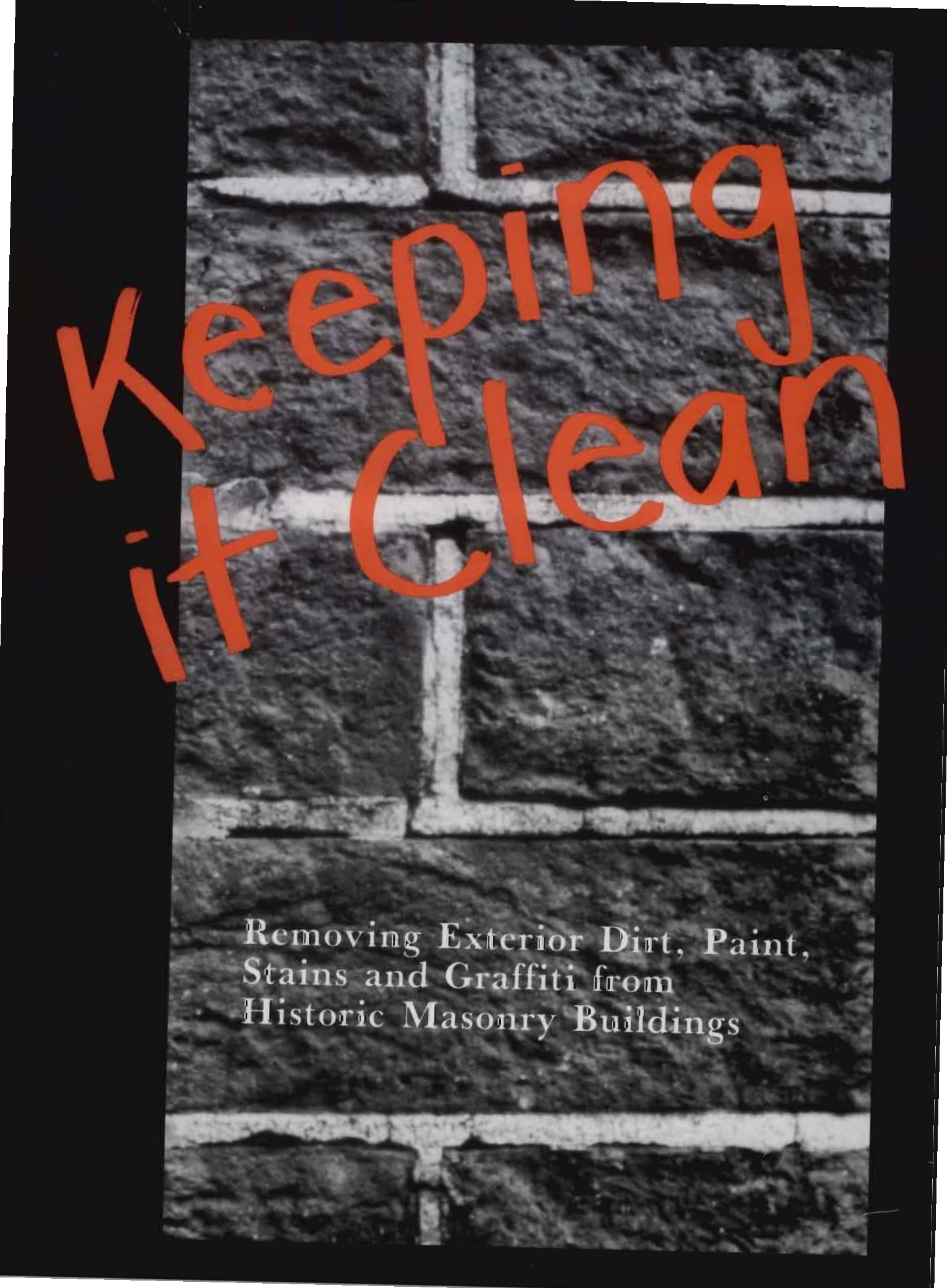
Keeping it Clean
Removing Exterior Dirt, Paint, Stains and Graffiti from Historic Masonry Buildings

# Keeping it Clean

## Removing Exterior Dirt, Paint, Stains and Graffiti from Historic Masonry Buildings

Anne E. Grimmer

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Heritage Preservation Services

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# Preface

Despite the inherent hazards, cleaning historic masonry,which includes stone, brick, architectural terra cotta, and cast stone, stucco and concrete, is one of the most common—and most visible—undertakings when rehabilitating or restoring historic masonry structures. Yet basic information and good technical advice may be hard to find. As a result, those responsible for the care of historic buildings frequently must rely upon the recommendations of a cleaning contractor or a cleaning product manufacturer who may not be completely objective, or familiar with all the cleaning options currently available. The cleaning of historic masonry should thus always be carried out under the supervision and guidance of a preservation or conservation specialist.

The purpose of this technical report is to provide information on removing dirt, stains, paint and related coatings, graffiti, and other disfiguring or potentially harmful substances from exterior masonry. First, however, there is a general discussion on all aspects of planning and carrying out a cleaning project, including anticipating potential problems; correctly identifying what is to be removed; identifying all building materials to be cleaned as well as other materials that might be affected by cleaning; and testing cleaning procedures to ensure the most successful project. The report also includes warnings about using certain techniques on specific building materials, as well as possible dangers to project personnel and the building's environment.

Unless otherwise credited, photographs were taken by the author.

The author wishes to thank Norman R. Weiss, whose two draft reports prepared for the National Park Service, *Exterior Cleaning of Historic Masonry Buildings* and *Removal of Stains and Paint from Masonry,* were invaluable in developing this publication. In addition, the author also wishes to acknowledge the contribution of the following individuals who provided technical comments on the manuscript: Frances Gale; Robert C. Mack, AIA; Frank G. Matero; Hugh C. Miller, FAIA; Judith Selwyn; National Park Service Regional Cultural Programs; and the staff of the Technical Preservation Services Branch, with special thanks to Kay D. Weeks, technical editor, Michael Auer and Theresa Robinson.

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## Part I What to Consider Before Cleaning

## Part II Choosing the "Gentlest Means Possible"

# Part I
# What to Consider Before Cleaning

## Reasons for Cleaning

There are two primary reasons for cleaning a historic masonry building: 1) to improve the appearance of the structure; and 2) to remove dirt, stains, coatings, efflorescence (salts) and pollutants that may be causing deterioration of the masonry. Generally, the two are intertwined, but the most common motivation for cleaning masonry is the desire for cosmetic improvement. It is easy to understand this rationale, especially considering the positive visual impact of a clean building.

### Cosmetic Improvement

A most important factor to consider before cleaning a historic masonry building is its patina—the color and surface texture, or the appearance which only time can impart. Patina usually includes a combination of surface stains, deposits, discoloration, and changes to the surface texture that may result from atmospheric dissolution and erosion. Naturally, patina includes a certain amount of dirt. As long as it does not contribute to, or conceal deterioration, patina is indeed part of the character of a historic building, and careful consideration should be given to its preservation. Determining when patina may be harmful or disfiguring must be done on a building-by-building basis, and will depend on the *type of masonry, the type and degree of soiling, and how much it might be obscuring damage to the masonry units themselves or to the mortar joints.* Careful removal of dirt and pollutant crusts can restore many aspects of the original appearance of the masonry—the color, texture and carved detailing that might have been hidden for years.

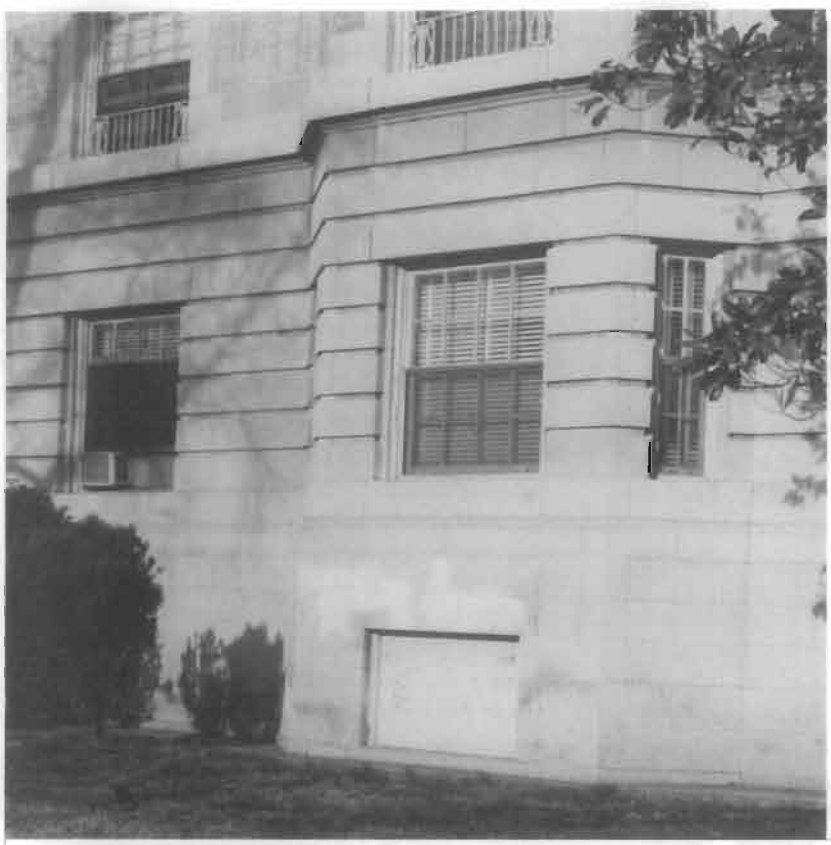


*Figure 1. When an inappropriate chemical cleaner was used to remove graffiti, it resulted in permanently bleaching the limestone foundation, and left a mark as unsightly as the graffiti.*

The unwelcome presence of graffiti usually triggers an urgent need for cosmetic improvement. An owner or building manager would likely want to remove graffiti as quickly as possible after it appears. Prompt removal is, in itself, a logical approach to the problem because it tends to discourage the incidence of more graffiti. On the other hand, if cleaning is undertaken too hastily, the results may be less than satisfactory (figure 1).

Removing paint from masonry, particularly from brick, is another common "cleaning" treatment, although it may not always be an appropriate or successful treatment for the building. Often, it may be preferable to retain the paint. Painted brick buildings were very popular throughout several historic periods. Many, in fact, were painted immediately after construction. Decorative treatments, such as the penciling of mortar joints, should be carefully examined; they may be original or may have acquired significance over the years. Paint may also have been applied as a protective coating, usually on

some of the more porous types of brick and sandstone; or applied to camouflage alterations or incompatible masonry repairs. All of these factors should be taken into consideration before paint removal is begun. If all nondamaging methods of paint removal have been tried and proven ineffective, it may be best to leave the masonry painted. Or, if the paint is in poor condition, the best approach may be to remove only the loose and peeling paint to a sound surface, and then repaint.

### Slowing the Processes of Deterioration

The strongest practical argument in support of masonry cleaning is that it may slow the processes of deterioration and decay. Heavy layers of dirt not only interfere with natural weathering and washing patterns, but also obscure deterioration (figure 2). Cleaning is often necessary to help the architect or building conservator detect problems, and correctly interpret them, in order to take corrective measures, and to prepare a regular maintenance schedule for the building. The cleaning process itself, as well as the close-range view of historic masonry afforded by the scaffolding or other access equipment, also provides an important opportunity to evaluate the condition of the building. Once rid of dirt and pollutant crusts, the conditon of the masonry will be more clearly revealed.

One of the best reasons for a regular cleaning program is that it may remove efflorescent salts from the masonry, thereby reducing potentially harmful salt buildup within the masonry,which can cause spalling or delamination. Regular cleaning or washing can help control plant or other biological growth on a building; it is a safer and gentler approach than applying herbicides that are potentially harmful to the masonry.

Generally, regular cleaning or washing is good preservation and maintenance practice for calcareous stones such as limestone and marble. But it is not as necessary for the less soluble siliceous stones, such as granite and some sandstones, nor for some brick and some glazed architectural terra cotta, all of which have a harder, more impervious outer layer, and are thus better protected from dirt penetration than calcareous stones.

*Figure 2. The building on the left is an obvious candidate for cleaning, as the heavy black crust may be concealing or contributing to deterioration of the stone. Despite its more recent cleaning, the stone facade of the house on the right exhibits the same distinctive, and hard-to-eliminate rainwater wash patterns under the eaves and window sills, as its unwashed neighbor.*

## Identifying the Masonry Substrate

### Avoiding Damage

The first and most important step to be taken before beginning any masonry cleaning project is to identify the masonry. When dealing with stone, it is important to select a cleaning method or chemical solution best suited for the kind of stone—that is, one that will not dissolve or etch it. It is also useful to have information about the chemical and geological characteristics of the stone. (For example, although most sandstones may be safely cleaned using acidic cleaners, some sandstones are calcareous, and thus may be damaged by acid.) Gathering detailed geological data is not always possible if the factors of time and cost are prohibitive. However, it *is* essential that the generic stone be identified (i.e., whether it is limestone, marble, sandstone, or granite) because of the differing properties of porosity, solubility and hardness, and mineralogical composition. It is these properties that determine which cleaning methods can be used without adversely affecting the stone.

## Tricks of the Eye

Another potential problem is that what might appear to be one type of masonry may actually be another. For example, architectural terra cotta, artificial cast stone, or pre-cast concrete were often manufactured to imitate natural stone. Pre-cast concrete or "cast stone" was being used imitatively as early as the late eighteenth century and still is to this day. Architectural terra cotta was used with this intent in the mid-to-late nineteenth century, and through the early twentieth century. Both materials were popular for decorative features such as window and door moldings. Terra cotta, in particular, was applied on upper floors of tall buildings where distance enhanced the illusion of stone.

Clearly, it is important to identify the material, since the best cleaning method for one type of masonry may not be as effective on another type, and may even cause damage. Many buildings feature a combination of materials. It is not unusual for a building or even a single facade to be composed of more than one type of masonry (brick with stone trim is particularly common), which may mean that more than one cleaning method will be necessary. If, after careful examination, there is any doubt about the type of masonry, a 3 percent solution of hydrochloric (muriatic) acid dropped from an eyedropper on an inconspicuous spot will quickly clarify the situation. This solution will bubble on calcareous stone, and on other acid-sensitive masonry, but will have no reaction on siliceous stone and acid-resistant masonry.

Indeed, some parts of a building, particularly decorative features, may not be masonry at all (figure 3). Frequently, such features as window hoods, cornices and balustrades may be metal, such as cast iron, galvanized sheet iron or zinc. When painted, they give an intentional appearance of masonry. Some features may have been fabricated of wood, then coated with a sanded paint to give the illusion of sandstone. Thus, the need to correctly identify the type of masonry, or other non-masonry materials on a building cannot be over-emphasized when planning a cleaning project.

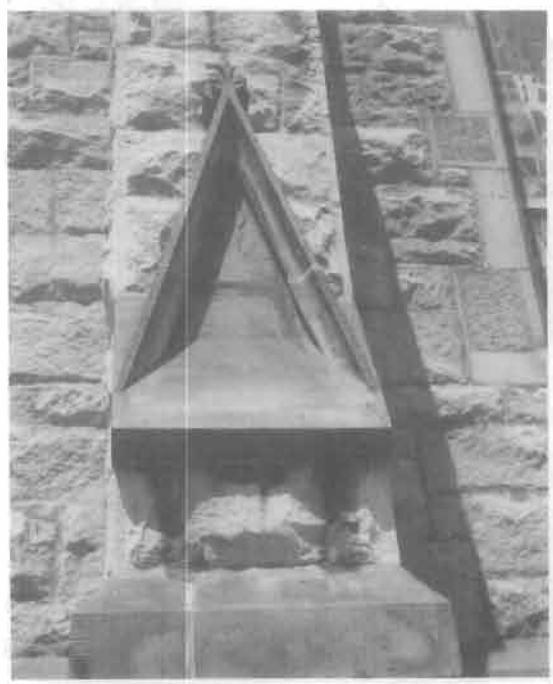
*Figure 3. Know what you are cleaning. If the painted surfaces of the projecting bay window on this once elegant Second Empire brick mansion were still intact, it would not be easy to identify the beltcourse as sandstone, the windows and window frames as wood, and the cornice and all of the window hoods as pressed metal. Cleaning so many different building materials may require a variety of techniques and treatments.*

## Identifying the Substance to be Removed

After the masonry substrate has been identified, the next step is to identify the substance or substances to be removed. The more information available about the substance to be removed, the more successful the cleaning effort will be. For example, the cleaning project can be greatly facilitated by knowing the composition of each paint layer, the cause or source of the stains, the primary components of the dirt, or the probable source of the efflorescence. And it is not uncommon to discover that all or part of a building has been treated with water-repellent coating. Unless the coating has caused discoloration or streaking, the fact that such a coating exists at all may be known only if cleaning test patches fail to react as they would on uncoated masonry.

## Dirt and Pollutant Crusts

Dirt or "soiling" on masonry buildings may consist of particles of dust, sand or grit, or tarry soot (resulting from incomplete combustion of fuels). The exact composition of the dirt will vary according to the geographic location of the building, as well as its use. A building in an urban, or heavily industrial area, is likely to exhibit a completely different type of soiling from a building in a rural or agricultural area—or a building near the seacoast or in the desert. While dirt and dust on one building may result from heavy vehicular traffic in the area, soiling on another building may result from human traffic.



*Figures 4a-4b. Decorative architectural features that project from a wall surface, such as this granite belt course above an intricately-tooled limestone lintel, and this sandstone pinnacle topping a limestone buttress, may shield or protect masonry surfaces beneath them. But they are also responsible for creating unusual "wash" patterns and black crusts that form underneath them, further complicating cleaning projects.*

Dirt or soiling may include disfiguring pollutant or sulfate crusts, which usually build up in sheltered or protected areas not regularly washed by the natural action of rain. It is particularly common under cornices, window sills, or other projecting decorative features (figures 4a - 4b). Some pollutant crusts resulting from a chemical reaction of stone to airborne particulate matter, or particules in which cementing material of the stone has actually incorporated itself, indicate the beginning of dissolution of the stone and incipient decay. Removing these crusts will necessarily involve a loss of a small amount of stone (figure 5). While removal is generally recommended because pollutant crusts hasten stone dissolution, extreme care must nonetheless be exercised to ensure that loss of the stone is minimized.

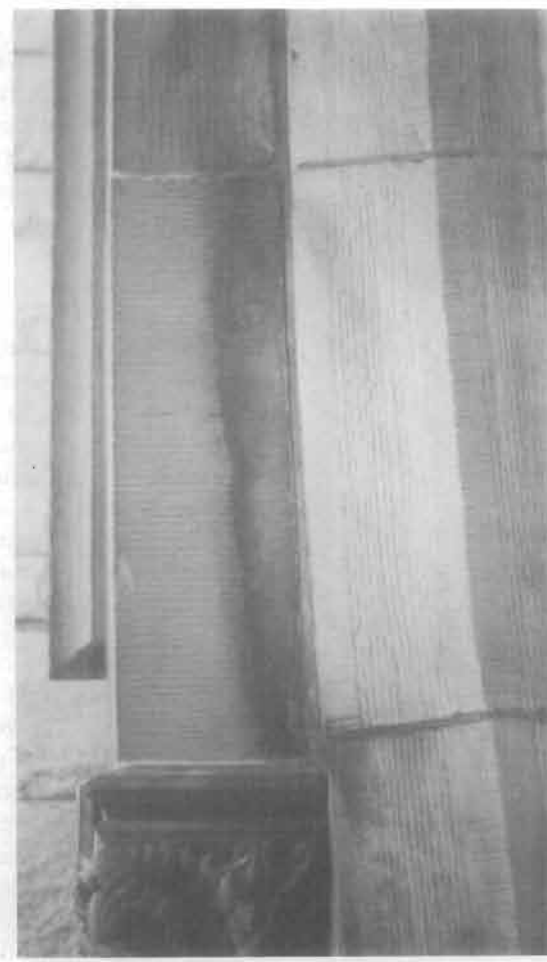


*Figure 5. It is unlikely that this blackened crust can be removed without some loss of the tooled sandstone surface, because the sulfate crust has become integral with the stone.*

### Stains

Unlike particulate dirt, which tends to lie on the surface, stains in masonry are discolorations produced by foreign matter that has penetrated into—or permeated—the masonry. Stains can also result from a chemical reaction between the masonry and the foreign matter, or from impurities in the masonry itself. Common masonry stains include metallic stains caused by iron (rust) or copper, industrial stains of grease, oil, and tar, and biological and plant stains caused by lichens, mosses, algae, and fungal growth such as mildew. Even after removal of the vines themselves, ivy and Virginia Creeper can leave their "marks" on the masonry, which may also have to be removed by cleaning. Discloration can also occur when mineral inclusions or impurities which occur naturally in some stones, or in the clay of some bricks, react to water or chemical cleaners.

### Graffiti

Graffiti created with paint or another medium may also be considered a stain. If graffiti is sprayed-on, it is generally likely to permeate the masonry (unless glazed or polished) in the same manner as most other stains. Thus, its removal must usually be carried out in the same manner as other stain removal.

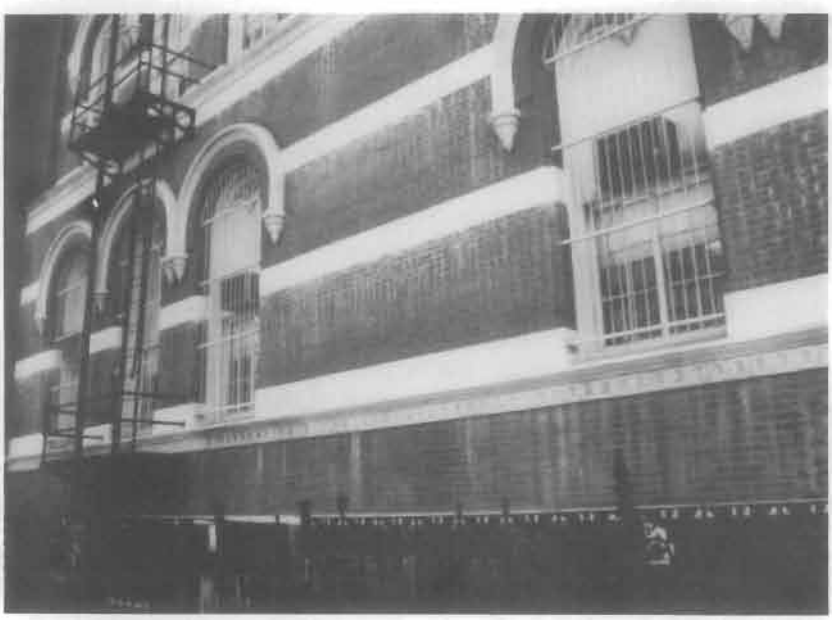


*Figure 6. Chalking white paint from decorative metal and stone stringcourses has "bled" and run down the unpainted brick walls. Unlike efflorescence, for which it might be mistaken, chalking generally cannot be washed off, and paint remover will be required.*

### Paint and Other Coatings

Removal of paint or other coatings will, of course, be facilitated by knowledge about the kind or kinds of paint, and the number of layers to be removed. For example, it is useful, if at all possible, to know whether the paint is oil-based, water-based, or, as is often the case, whether it consists of a variety of paints and coatings, which might include layers of cementitious masonry paint, whitewash or limewash. In some cases, the pigment might be incorporated into the substrate, as is often typical of stucco and traditional limewashes.

Questions may arise about each layer or coating, further complicating the overriding need to remove the offending substance while not damaging the historic masonry. For example, if there is more than one layer of paint, is it consistent over all of the building surface? Or is there an "invisible" water-repellent coating or a wax coating, or perhaps even worse (from the standpoint of removal), an asphalt or bituminous waterproof coating on some areas? If so, will it come off successfully, or might it be better to camouflage it by repainting?

### Efflorescence

Efflorescence, the result of capillary action pulling soluble salts up from the ground into the masonry, usually appears as a whitish haze on the exterior surface of masonry. Sulfate deposits may result from carbonates in lime mortar and airborne or water-deposited pollutants in the atmosphere. Another common source of efflorescence in brick is the firing process itself.

Efflorescence may also appear on a masonry surface after chemical cleaning. Some efflorescence is temporary, and will be removed by rain. Other types may disappear for awhile, but return periodically, and some require considerable and repeated efforts to eliminate. It is therefore always necessary to ascertain the source or sources of efflorescence, and it may even be useful to identify the salts that comprise the efflorescence. Further complicating the identification process, white paint from a painted surface above that has "bled" onto a

masonry surface below (particularly common under window sills) might be mistaken for efflorescence (figure 6). In short, it is very easy to misinterpret what is on the surface.

### Combination Problems

Often, a cleaning project will involve removal of more than one substance. What first appears to be a straightforward task of paint removal may be complicated by the discovery of multiple layers of different types of paints and coatings on another elevation of the same building, or perhaps on only the first floor of the building. Moreover, what may initially appear to be one substance may, upon closer examination, turn out to be another, or often a combination of substances.

## Project Personnel

Once the masonry and the substance to be removed have been identified, the next step is to match potentially appropriate cleaning methods with the particular project at hand.

### Role of the Preservation Consultant

To ensure the best possible job, a professional preservation consultant should be retained, preferably someone with a technical or scientific background (an architectural conservator, a restoration architect, or a chemist or geologist). The advice of cleaning contractors or product representatives may be prejudiced by familiarity with only one or two cleaning techniques, or a desire to sell a particular product. Generally, their recommendations should not be substituted for the experience and impartiality of a technical preservation specialist or scientific consultant.

Basically, the consultant should supervise all aspects of the cleaning project—planning, identifying the masonry, identifying what is to be removed, selecting the cleaning methods and materials, selecting the contractor, and supervising the actual cleaning to ensure consistent quality and to minimize any possible damage to the surface.

**Role of the Preservation Consultant**

- Identify the building's materials.
- Evaluate condition of the masonry materials.
- Identify what is to be removed.
- Supervise the testing of the cleaning methods.
- Analyze the test patches.
- Based on the test patches, select the cleaning methods that most effectively clean the masonry without causing damage.
- Prepare specifications based on these test results (if they have not been prepared already prior to testing).
- Select cleaning contractor (if not already chosen).
- If possible, have cleaning test repeated by cleaning personnel who will do cleaning.
- Supervise actual cleaning process to ensure consistent quality.

### Selecting a Cleaning Contractor

A carefully executed cleaning job requires the experience of a reputable cleaning contractor who specializes in cleaning and restoring historic masonry buildings. Negotiating a fair price with one qualified contractor may be preferable to asking several contractors to bid on the cleaning job. The bids and final contract should be based on specifications prepared by the independent preservation consultant. A good contractor should be willing to provide information on the cleaning process, and on the product ingredients, and also provide references in the form of completed cleaning projects.

It is important that a consultant, who is experienced in such evaluations, visit at least one or two projects in order to inspect the quality of the work. A well-executed cleaning project should not show any signs of mechanical or chemical abrasion, nor should it exhibit areas or patches of efflorescence, which might indicate the use of too strong a chemical or improper or inadequate rinsing. (Sometimes efflorescence on a very recently cleaned building is only temporary, and will gradually wash away. It may be the result of salt-laden moisture *within* the masonry

suddenly being released when surface dirt or a coating is cleaned off.)

A responsibly and sensitively cleaned historic masonry building should retain some of its before-cleaning patina, perhaps appearing slightly "dirty," as if it had not been overcleaned. Clearly, however, there may be some aspects of a recently cleaned surface that are not so easy to explain. Sometimes an abraded or eroded surface is the result of natural weathering or a "flaw" in the original materials, or damage from an earlier, harsh cleaning treatment. Or what appears to be a stain may, in fact, be the result of an unexpected reaction of a natural impurity in the stone to a chemical cleaner. In short, as will be repeated again and again, it is not always possible to predict the exact outcome of a cleaning project because of the many variables associated with historic masonry. But despite some unavoidable uncertainty, a cautious, conscientious approach by the consultant, building owner or manager, and the contractor will always result in a better cleaning project—one that does not damage the historic masonry.

Although cost is often a factor in a cleaning project, the contractor should not be selected solely on the basis of a low bid, but rather on the quality of previous work, as well as *on* the basis of test patch results. Local historic district commissions and review boards, State Historic Preservation Offices, regional offices of the National Trust for Historic Preservation, local chapters of the American Institute of Architects (AIA) and the Association for Preservation Technology (APT), may be able to suggest reliable consultants and cleaning contractors experienced in cleaning historic buildings.

## What to Require in a Contract and Specifications

Because cleaning a historic masonry building involves so many unexpected and unknown factors, each project is unique. It would be impractical to try to provide a standard set of specifications to cover *all* of the potential situations that might be encountered. But, while the actual specifications will vary from project to project, there are certain principles that should govern any cleaning project to ensure the best possible outcome.

1. The specifications should be very precise. The more specific they are, the less chance there is for mistakes.
2. Qualifications of project personnel should be included in the specifications.
3. If specifications are prepared before testing, they should clearly state that mock-up test areas will serve as quality-control for the project.
4. If testing has already been carried out, the specifications should state the exact cleaning method (technique and materials) to be used based on the testing.
5. If a specific product is to be used, it should be clearly stated so that the contractor is aware that *no* other product may be substituted, unless it is with the prior approval of the preservation consultant or supervising architect—and of course, only after it has been tested on the building. A building may often require more than one cleaning method or cleaning product. If so, each method to be applied to a different material and in a different location on the building should be identified.
6. The cleaning process should take place only under the careful supervision of a qualified professional preservation consultant or preservation architect. The cleaning method outlined in the specifications will have been prescribed only after careful testing on the building with time allowed for weathering. Any unforeseen problems that might arise during the course of the cleaning should be brought to the attention of the consultant (and the owner), and the cleaning halted until the problem is solved.
7. Finally, even a well-written specification is of no use if it is not read and followed.

## Testing

Because of the wide variety of unforeseeable factors, the cleaning method or methods should always be tested on an inconspicuous area of the building and preferably in more than one location (figure 7). Such tests must be carried out before attempting any large-scale masonry cleaning project. Failure to do so may have disastrous consequences for the outcome of the cleaning as well as the long-term preservation of the historic building material. Testing should be carried out by the consultant or conservation specialist, or by the contractor, under the consul-

*Figure 7. A contractor prepares equipment before testing a low-pressure water wash on a Roman brick and terra cotta building. Photograph: Sharon C. Park, AIA*

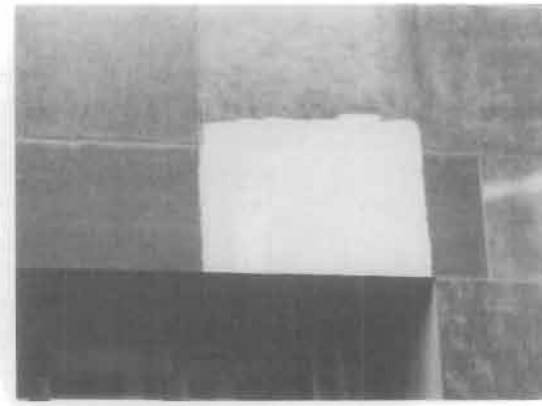


*Figure 8. A test cleaning patch (unfortunately in a rather prominent location) on limestone discolored by urban grime and pollution reveals a marked color difference between the cleaned and the uncleaned stone as well as an unexpected discoloration (probably caused by a substance splashed on the wall at an earlier time). Removal of this spot may require a special cleaning treatment. Photograph: Sharon C. Park, AIA*

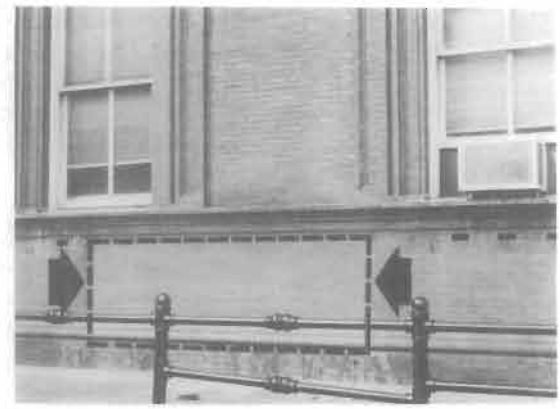


*Figure 9. A test patch on brick to remove a century of dirt reveals only a slight difference in appearance between the cleaned and the uncleaned brick. The hard-baked outer skin of the brick provides a surface that is not only impervious to dirt penetration, but resists dirt accumulation. Photograph: Christina Henry*

tant's careful supervision. Carefully controlled testing is probably the only reliable way to determine the best or most appropriate cleaning techniques and pressures to be used in a particular project (figures 8-9).

**Selecting an "Appropriate" Water Pressure**

The process of selecting the most appropriate water pressure should always begin with the lowest pressure, or the "gentlest means possible," proceeding gradually to a higher pressure, as needed. Although that philosophy is certainly sound, its application in a practical sense is very much more difficult. The difficulty lies in the fact that, although the terms "low," "medium" and "high" pressure have traditionally been used in cleaning specifications, they are general terms and subject to wide interpretation. Because of incalculable or unpredictable factors associated with pressure equipment—combined with different types of historic masonry itself—it is virtually impossible to define the categories of low, medium and high in a manner that would apply equally to all cleaning projects.

Precise definition of these pressures is further complicated by the fact that pressure measurement, or psi (pounds per square inch) varies according to the following: pressure as measured by a gauge at the pump; the volume of water (or other liquid cleaning agents) delivered per minute; the size of the nozzle or spray head opening; and the distance between the spray head and the masonry surface. But since most psi measurements are taken at only one location, these seemingly precise measurements may bear little or no relationship to the actual pressure reaching the building. As the variables multiply, it becomes more and more obvious that psi numbers do not really mean very much, or at least do not mean the same thing to all who employ them in cleaning. Thus, although exact pressures may sound precise, the fact that they are not must be kept in mind.

For this reason, until a system can be perfected that will allow greater certainty or precision, selecting a cleaning method and pressure should be done only after careful testing has produced a satisfactorily cleaned test patch to serve as a standard by which the rest of the project can be measured. *Thus, references here to specific pressures are provided only for comparative purposes, and should be considered only as general guidance.*

### Choosing Representative Types of Masonry

Finding the appropriate cleaning method can be further complicated when dealing with especially fragile, damaged or deteriorated masonry. These are factors that must be taken into consideration when planning to clean historic masonry.

Areas of the building chosen as test spots should accurately represent the types of masonry material to be cleaned. As noted earlier, another masonry material may have been used to simulate stone. Also, a harder, higher quality brick or "face brick" was often used on the facade, while the less visible side and rear elevations were often covered with a cheaper, usually softer "common brick" as an economy measure. Results from a cleaning test performed on common brick, or a heavily textured brick, would probably not be applicable to smooth, face brick. Likewise, tests on upper parts of a building may not accurately reflect conditions on other areas, such as the foundation or horizontal surfaces that may have been treated with a waterproof or water-repellent coating.

### Choosing Representative Soiling

The area or areas selected for testing should represent both the amount and type of the dirt deposits, surface pollutant crusts, stains, efflorescence, or paint on the majority of the building surface. For example, a prominent area of the facade may be stained, disfigured with a heavy coating of soot, or covered by heavy paint buildup. Another area of the building may be only lightly soiled or have only one coat of paint. These might require very different cleaning procedures. A project that proceeds after testing a limited area only might produce very unsatisfactory results.

To ensure the most accurate test results, as much as possible of the dirt, bird droppings, or problem substances should be removed from the surface by hand-scraping or brushing with non-metallic brushes *before* test cleaning. (This same practice should, of course, be followed when the actual cleaning is undertaken.)

### Evaluating the Test Patches

Althought a somewhat larger area is preferable, an area approximately one square meter or approximately one square yard will generally serve as an adequate test patch. If there are different types of masonry, or widely dissimilar substances to be removed, several test patches may be necessary. Representative, but inconspicuous areas should be chosen in case any of the tests are not successful, or in case the project does not progress beyond the testing stage.

One building, regardless of size, may require a variety or combinations of cleaning methods. If the type of scaffolding allows, it is advisable to clean the entire building using the gentlest technique to remove the prevailing substance. Then, localized stains on decorative features can be addressed individually. Too strong a cleaner for overall cleaning may harm the masonry. Instead, a milder cleaning solution should be used and augmented, if necessary, by additional applications on hard-to-clean areas or difficult stains. *Always underclean, rather than overclean.*

Test patches can be evaluated accurately only after they are dry. If chemical cleaning is being tested, non-staining pH papers should be held on the surface of the test patch area before and after cleaning to determine if any acidic or alkaline residues remain on the surface. If residues are detected, additional water rinsing or application of a neutralizing solution should be carried out until pH tests indicate that all residues have been removed.

A test patch should be allowed to weather as long as possible before the cleaning project is begun to give ample opportunity for an accurate evaluation of the results. One year is the preferred amount of time; this allows the patch to be exposed to a complete weathering cycle (figures 10a-10b). If this is not feasible, it is a good idea to

*Figures 10a-10b. This test cleaning patch on brick and sandstone was allowed to weather over a full year, while other aspects of the rehabilitation were carried out. Finally the entire building was cleaned with a proprietary paint remover sprayed-on under low-pressure and then rinsed by workmen from a truck-mounted hydraulic platform lift.*

wait as long as possible, and at least one month at a minimum. Once a cleaning project is begun, the work should proceed in clearly defined areas (preferably delineated by structural or architectural features), since it is difficult to match cleaned areas, especially if the project is halted for several days or more.

**Reasonable Expectations**

Tests are usually carried out under optimum conditions, and may therefore show better results than the actual cleaning project. For example, a cleaning contractor bidding on the job will naturally try to achieve the best possible result in a sample cleaning area in order to obtain the contract. It is also easier to clean a small area at ground level within a specified amount of time than to achieve the same results several stories above ground by workers who are tired after a long day's work. Overly optimistic estimates of time and costs supplied by a contractor based on the results of a test patch can be misleading.

But an experienced and reputable contractor will be aware of these inherent problems and should be able to provide a reasonable estimate based on the testing.

The test patches serve as a "standard of clean" and will provide guidance regarding the best cleaning method for the job; for example, how many applications of the cleaning material will be necessary if a chemical product is used, the dwell time (the length of time an application should remain on the surface), and what pressures should be used for the cleaning and the final rinse.

## Scheduling the Cleaning Project

One of the most important considerations in a cleaning project is scheduling. Since the cleaning method cannot be selected until several techniques have been tested, it follows that the test patches should be done at the start of a rehabilitation or restoration project. And, because of the need for adequate time for the cleaning tests to weather before selecting one, the actual cleaning itself should be the last, or one of the last things to be done in the project.

*Never* begin cleaning when there is any likelihood of frost or freezing, as most cleaning operations involve the use of water. When the water penetrates the masonry pores during cleaning, the interior of the masonry retains moisture for

some time before it evaporates, even though the exterior surface may appear dry. If a frost occurs, the moisture inside the masonry units will freeze, which could eventually cause the masonry surface to spall. The presence of salts within the masonry wall may exacerbate the process.

The best times to clean a historic masonry building (other than in tropical or arid climates) are late spring, early summer and early fall when there is no danger of freezing. While warmer temperatures contribute to a faster chemical reaction, too much sun and too high temperatures do not result in a good cleaning project either. If cleaning is done in very hot weather, the masonry should be shielded from excessive heat by hanging protective netting or tarpulins around it.

Repointing, if necessary, should generally be carried out before cleaning to prevent damage to interior surfaces caused by liquid cleaning materials penetrating through open joints in the masonry.

## Minimizing Hazards of Cleaning

Although most large-scale cleaning projects should be carried out by qualified cleaning professionals accustomed to working with historic buildings, it is still important to keep in mind all of the precautionary guidelines associated with masonry cleaning. Potential harm to the historic masonry and other building materials often used in conjunction with stone and brick, as well as potential harm to the environment and cleaning personnel must be carefully evaluated before initiating a cleaning project.

### Protecting the Historic Building

Mortars, especially those of the traditional lime-based formulations, are among the most vulnerable substances to be considered when preparing to clean a historic masonry building. Deteriorated mortar joints can lead to major problems with water washing and other aqueous techniques. The entry of large amounts of water through spraying or prolonged misting may result in damage to interior plaster and other finishes, and in exterior staining as well. Water pressures for cleaning and rinsing operations should be monitored carefully to minimize physical damage to the masonry. Loose mortar can be dislodged by rinsing at too high a pressure, permitting deep penetration of water within the building.

The acidity or alkalinity of cleaning chemicals must be controlled to suit the chemistry of the individual masonry materials. Because chemical cleaning with acidic products is always potentially dangerous to acid-sensitive masonry and lime mortars, acidic cleaners must therefore be diluted carefully, in keeping with the sensitivity of the masonry. To accomplish this successfully, accurate identification of the masonry is essential. This may not be easy. Limestone and some cast stone, or other types of artificial stone, can look very similar.

Many other historic building materials can be damaged by chemical cleaning agents. Glass, glazed brick, and architectural terra cotta will be etched by strong solutions of hydrofluoric acid if not covered adequately. Metal, wood and paint can all be damaged by chemical cleaners, and must be shielded. Such materials can be temporarily protected by plastic sheeting or peelable coatings specifically made for this purpose (figure 11).

*Figure 11. Removal of 100 years of grime from the brick and terra cotta facade of the Pension Building (now the National Building Museum), Washington, D.C., was accomplished by workmen on a swing stage using a chemical cleaning product. Note the polyethylene covering the windows to prevent damage. Also note the protective clothing for the workmen which hangs on the platform while not in use. Photograph: Christina Henry*

## Protecting the Environment

Damage to property, shrubs, trees and ground vegetation in the immediate vicinity can be avoided by using proper controls to avoid overspraying and by covering or shielding plants and property. Site drainage must always be considered when using an acqueous cleaning method, and disposal of toxic chemical runoff and dissolved paint may pose an even greater problen. Lead paint sludge should be placed in suitable containers and disposed of in accordance with enviromental regulations. In the case of organic solvents, a well-designed storage location is necessary to prevent explosion and fire. Use of many of these cleaning materials may require special permits or approval from local authorities, especially if run-off is to be channeled into city storm sewers.

## Protecting Cleaning Personnel

Cleaning compounds pose many safety and health hazards, and working personnel must be equipped with protective clothing, gloves and toxic vapor masks. Strong cleaning agents can cause skin burns and irritation, and adequate eye protection is essential at all times. Hydrofluoric acid can cause severe burns and can also penetrate the skin, resulting in bone damage. Organic chemicals are equally health-threatening, because they are absorbed systemically through the skin and are carcinogenic. When using spray equipment containing acid cleaners, extreme caution must be taken to release the pressure slowly so that the contents do not spray or splash the operator.

# Part II
# Choosing the "Gentlest Means Possible"

Most cleaning techniques suitable for use on historic masonry buildings rely on aqueous or water-based systems, and chemicals. Water-based solutions (which can include detergents) and chemical solutions can be successfully applied separately or in combination, aided by a variety of hand-scraping methods. Properly used, these techniques can safely remove dirt, stains, graffiti, paint or other surface coatings, efflorescences (salts), and plant and fungal growth and stains from historic masonry buildings.

## Water Cleaning to Remove Dirt

*all types of masonry*

Water-based cleaning can be the gentlest and simplest operation, causing the least amount of damage, if certain precautions are followed. It may also be the least expensive cleaning procedure. It is probably the most versatile technique available for sensitive cleaning and removal of dirt and pollutant crusts from *all* types of historic masonry materials, and it is generally the *simplest* method for cleaning limestone and marble. While there are several cleaning methods in which water is the sole ingredient, water is also the principle cleaning agent in other methods which utilize detergents and chemicals.

There are four principal types of water washing: soaking (misting and spraying); low-pressure and medium-pressure water washing; low-pressure and medium-pressure water washing supplemented with non-ionic detergents; and steam cleaning, by itself, or supplemented with non-ionic detergents.

### Soaking (Misting or Spraying)

Prolonged spraying with a fine mist is a relatively simple washing method. This technique provides maxium wetting using a minimal amount of water. A mist is produced by inserting fine mesh filters over hose nozzles. Continuous soaking of the surface is then accomplished by running lengths of punctured hose (or a moveable pipe, or one supported on scaffolding) hung under the eaves or along the cornice line of the building. Water pumped up through a compressor at ground level slowly trickles down or sprays the building facade.

Low-pressure, low-volume misting devices with a wide angle of coverage may be the most efficient of the soaking techniques. They can also be set up to handle selected areas of heavy dirt or soot encrustation such as black sulphate or gypsum crusts that form in protected areas (especially under moldings and eaves not washed by rainwater) on limestone, marble and other calcareous stones. The effectiveness of this method relies on the fact that the sulfate crust, in which the dirt is incorporated, is several times more water soluble than the stone. Thus, water loosens the gypsum crust by partial dissolution, along with the material trapped within the network. As the description implies, this is a slow process and may take from four to six hours up to a week or more to soften heavy crusts or dirt deposits. After the dirt has softened, its removal can be facilitated by hand-scrubbing with non-metallic brushes or by using a moderate-pressure water wash; a wooden scraper may help in removing heavy sulfate crusts. A variation of this method is a timed schedule, or pulsed spray, which alternates periods of soaking (misting or spraying) with dry cycles, using a timer to regulate the intervals so the masonry does not dry out. This approach is also good for loosening dirt and pollutant crusts, although its use has been fairly limited in the United States. Before deciding to use any aqueous system, stone should be tested for free iron (iron not completely bound) to avoid the possibility of iron staining.

### Low-Pressure and Medium-Pressure Water Washing

Another water-based cleaning method is low and medium-pressure "power" washing. It is always best to start with the lowest pressure possible, and to increase

the pressure only as much as necessary to loosen the dirt and adequately clean the building. Low-pressure water washing can be carried out with a common garden hose in a small-scale cleaning project, that is, one limited to a two-story structure that can be reached conveniently with a ladder. Again, removal of heavy grime can be facilitated by hand-brushing and scraping prior to washing. This is a very effective, gentle, and easily controlled method, unlikely to cause any harm to the building.

Low-pressure washing may also be successfully used for some large-scale cleaning projects, requiring scaffolding, or perhaps a "man lift" to provide access. Deteriorated areas will need specialized treatment, possibly by hand. After cleaning a building with heavy dirt encrustation, a final rinsing or a second cleaning using chemicals may be necessary in order to remove dirt already loosened by the initial washing.

**Low-Pressure and Medium-Pressure Water Washing with Detergent Supplement**

The best combination of prolonged spraying or dripping, low-to-medium-pressure washing, and brushing and hand-scraping, must be determined experimentally and on a case-by-case basis. While polished surfaces such as polished granite or glazed architectural terra cotta may sometimes be cleaned effectively of dirt simply with a low-to-medium-pressure wash, adding a non-ionic detergent that does not deposit a solid, visible residue, may often hasten cleaning. (Examples of non-ionic detergents include Tergitol by Union Carbide, Triton by Rohm & Haas and Igepal by GAF). Non-ionic detergents will also be needed to clean most textured masonry such as rusticated stonework, rough-surfaced brick, and intricately carved ornamental details; textured surfaces that hold dirt will require additional cleaning effort by hand-brushing with non-metallic brushes. After cleaning, it is important that the surface be carefully rinsed because, while not visible, a "gummy" detergent film tends to attract dirt.

With the exception of steam cleaning, which utilizes heated water, most water-based cleaning methods discussed here can be carried out successfully with cold water. Under certain circumstances however, warm or hot water may facilitate the cleaning process when removing greasy or oily dirt or stains, and sometimes in paint removal.

**Steam**

Steam cleaning is another water-based cleaning method. Although once used extensively, it is no longer as popular, possibly due to the increased sophistication of chemical methods. In this procedure, steam is generated in a flash boiler and directed against the masonry surface with the use of a very low-pressure (10-30 psi) nozzle, generally with a ½ inch diameter aperture. The heat of the steam swells and softens dirt deposits enough so that the low pressure of the steam is generally sufficient to remove the loosened dirt from the masonry surface. However, the density of the steam makes it difficult for the operator to see or monitor the cleaning process, and because the steam is heated to such a high temperature, it is not only a potential hazard to the operator, but may damage the stone as well.

Steam cleaning is most useful today as a method of removing vine disks and other vegetation clinging to masonry surfaces, and for cleaning small, hard-to-reach or highly carved or ornamented areas without causing mechanical damage. In such instances, it may be necessary to precede the steam cleaning with manual scrubbing using a non-ionic detergent or a low concentrate chemical-based cleaner, or to follow steam cleaning with a low-pressure water rinse. Steam cleaning may also be a suitably gentle method for cleaning damaged or friable stone. Steam cleaning is a technique that, under careful supervision, may occasionally be used for specialized interior cleaning because it does not produce large quantities of water, and therefore reduces the possibility of damaging fine finishes.

***Cautions and Precautions.*** Despite the fact that water washing methods may be the gentlest of all cleaning methods they are not without hazards. Even these methods can be abrasive. Water pressure should always be kept at the lowest level that will clean the masonry without damage. Too highly pressurized water can etch or otherwise scar masonry, and may penetrate through the masonry walls (figure 12).

*Figure 12. Water at too high a pressure from a pinpoint nozzle has etched this white Vermont granite. Photograph: David A. Look, AIA*

With any aqueous cleaning system it is generally recommended that a masonry building be repointed, if necessary, before cleaning (allowing ample time for the pointing to cure adequately before cleaning, as the water may dislodge green mortar). Another possibility is to use caulking compound to fill in some of the larger gaps in the mortar joints temporarily to prevent water infiltration during cleaning. Before embarking on an aqueous cleaning project, it is important to make sure that the flashing around chimneys is tight, and that there are no open joints around doors and windows where water may enter.

Long periods of soaking or spraying may result in excessive moisture penetration of masonry walls, possibly leading to corrosion of metal anchors, and consequent exterior staining, or damage to interior plaster and paint finishes. To avoid these problems, cleaning personnel should inspect the interior periodically to check for moisture penetration. Prolonged soaking or spraying may also irreversibly weaken the masonry itself, since masonry, like other porous materials, tends to decrease significantly in mechanical strength when saturated.

Water cleaning of a moderate size building can require several million gallons of water. When such large amounts of water are involved, it is important to have a good drainage system available for the run off. Additionally, many city water systems may be heavily chlorinated or have a high mineral content. If this is the case, the water used for cleaning should be purified or distilled to avoid introducing chloride salts into the masonry or mineral deposits onto the masonry surface. In addition, water should be pumped through plastic, rather than copper, pipes to avoid possible staining of the masonry. Water cleaning may be rather time-consuming and expensive, particularly if the removal of heavy crusts requires much hand-scrubbing.

It is important to realize that although some types of masonry may benefit from frequent water washing, others do not. While useful as a method of revealing sources of potential deterioration covered by dirt, frequent washing of some of the harder siliceous stones including granite and some sandstones, as well as brick, probably does not aid in their preservation. But the opposite is generally true of calcareous stones such as limestone and marble, whose long-term preservation may be enhanced by regularly scheduled water washing. Regular cleaning of calcareous stones (perhaps every seven to ten years in heavily polluted urban areas) can remove potentially harmful absorbed salts. On the other hand, calcareous stones also tend to be highly soluble and *too* frequent washing may result in accelerated dissolution and loss of surface caused by the slightly acidic water of some city water systems. In general, washing procedures for these stones should not be overly long to avoid excessive exposure of the stone to the dissolving nature of the water. The use of distilled water may further minimize dissolution.

To prevent possible staining of light-colored limestone or marble in areas where the local water supply has a high iron content, it may be useful to add a chelating or complexing agent such as EDTA (ethylene diamine tetra-acetic acid), to the wash water; this will combine with any metal ions present in the water and keep them in solution to avoid metal stains on light-colored stone.

## Chemical Cleaning to Remove Dirt

If water-based cleaning is the gentlest and least damaging method of removing dirt from historic masonry, chemical cleaners represent the next level of intervention. Chemical cleaners may be required to remove heavy dirt buildup or layers of paint. Chemical-based cleaners for

masonry are generally one of three types: acidic cleaners, alkaline cleaners, or organic solvents. Acidic or alkaline cleaners are used for regular cleaning or dirt removal; alkaline cleaners or organic solvents are used for paint removal. All of these cleaners rely on water and most contain surfactants ("surface active" agents)—organic compounds that concentrate at oil-water interfaces, and exert emulsifying actions, and thus aid in removing soiling. (Sometimes the term "surfactant" is used interchangeably with "detergent.")

Pre-wetting masonry surfaces is generally recommended for both acidic and alkaline products. In addition to loosening the dirt, this reduces the amount of the cleaning agent and the dirt-laden rinse water that can soak into the masonry and the contiguous mortar joints. Chemicals are then brushed or sprayed on under low pressure—brushing the chemicals on may actually help loosen surface dirt. When surfactant products are used, spraying or brushing generates suds that boost cleaning efficiency by lengthening contact time of the active chemicals with the masonry. Manual scrubbing with a non-metallic brush can have the same effect, and also assists in loosening dirt. After a few minutes (as indicated in the product literature or determined by testing), the cleaner is washed off by flooding the surface with a moderate-to-high (400-600 psi) water spray at a rate of three to four gallons per minute, rinsing from top to bottom. Extremely heavy dirt accumulations or many layers of paint may require repeated applications of the chemical cleaner. A hot water rinse may also facilitate paint removal.

**Acidic Cleaners**

*most granites, most sandstones, slate, unglazed brick, unglazed architectural terra cotta, concrete*

Acidic products can be used on unglazed brick and terra cotta, and most granites, sandstones, slate and other non-calcareous or siliceous stones. But acid-based cleaners generally should never be used on acid-sensitive materials that might be etched or abraded by acid. This includes masonry with a glazed or polished surface (glazed architectural terra cotta, glazed brick, polished stone or glass) as well as acid-sensitive stone such as limestone, marble, or calcareous sandstone.

Acidic cleaning is a two-part process: first, the acid cleansing solution is applied to the pre-wet masonry surface. After completing its action, the acid solution is then removed from the masonry by a thorough water rinse. Hydrofluoric acid is the most commonly used acid cleaner for historic masonry, usually with some phosphoric acid added to prevent development of rust-like stains that may appear after cleaning. Hydrofluoric acid specifically dissolves carbonaceous pollutant products, or dirt, and in most cases does not leave water-soluble salts in the masonry if the cleaning is properly carried out. It should preferably be used at a concentration 0.5 percent, but may be used at concentrations as high as 5 percent.

Hydrofluoric acid works on granite, slate, sandstone and brick by dissolving a minute amount of their surface, thus releasing the dirt. In this way, the introduction of potentially harmful residual salts into the masonry is kept to a minimum. The masonry should be kept moist throughout the cleaning operation to avoid silica deposition (efflorescence or the formation of a whitish powder). As most chemical cleaners (both acidic and alkaline) must remain on the surface for several minutes, keeping the masonry moist will also maximize cleaning efficiency. A second or third application of the cleaning agent may be necessary to remove particularly heavy dirt deposits.

Most commercially available products contain thickening agents to form gels or pastes that improve the cleaning agent's ability to cling to vertical surfaces. They also contain secondary solvents of a lower evaporation rate than water, such as glycerine to enable the cleaner to remain moist longer on the masonry surface. However, care must be taken to avoid exposing the masonry to cleaners containing hydrofluoric or other acids for more than five to seven minutes.

A variety of commercially prepared acid-based cleaners for masonry is available: products for granite, brick and sandstone, afterwash products, concrete cleaners and mortar removal products. The principal ingredient in granite products (restoration cleaners) is hydrofluoric acid. The afterwash products contain weak organic acids such as acetic acid. The mortar removers and concrete cleaners are based on

hydrochloric acid. Many of these commercial products are very effective on historic masonry buildings if used according to the manufacturer's directions and under the supervision of a preservation consultant.

It may be difficult to obtain a list of all the ingredients or their exact proportions for most of these products, since they are usually of a proprietary nature, and not patented. However, the Occupational Safety and Health Administration (OSHA), requires that Material Safety Data Sheets be supplied by manufacturers to distributors upon request; the provide information about all hazardous contents in commercially available cleaning products.

***Cautions and Precautions.*** Hydrofluoric acid-based cleaners can sometimes leave whitish deposits of silica, or calcium fluoride salts (efflorescence). These deposits are generally not harmful to the masonry but may be disfiguring, especially on darker masonry. Since this efflorescence is soluble in hydrofluoric acid, it can usually be removed by a second chemical treatment, followed immediately by a thorough cold water rinse. It should be noted that hydrofluoric-based cleaners left too long on the masonry may result in a colloidal silica deposit that may be almost impossible to remove (figure 13).

*Figure 13. While hydrofluoric acid-based cleaners are often appropriate for cleaning unglazed brick, they may form hard-to-remove whitish silica deposits if left too long on the surface.*

Although cleaning non acid-sensitive masonry with hydrofluoric acid-based products is generally a relative safe undertaking—using proper precautions—hydrofluoric acid may lighten the color of some sandstones containing iron. This is another reason why it is always important to test the product on the masonry before beginning a full-scale cleaning project. Hydrofluoric acid can also severely etch aluminum and glass; therefore, these materials must be covered with acid-resistant coatings for protection during cleaning.

Hydrochloric (muriatic) acid is a very strong acid and thus should generally not be used as a cleaning agent on historic masonry (even when diluted). Rather than cleaning or dissolving dirt, it dissolves lime-based mortars and even some stones, and leaves chloride deposits on the masonry surface. *The fact that it dissolves lime-based mortar as well as lime contained in some stones clearly illustrates that its use on historic masonry is generally inappropriate, since many historic mortars have a high lime content.*

When used as a cleaning agent, hydrochloric acid also tends to result in the formation of water soluble salts in the masonry itself, which even thorough surface rinsing is unable to remove. Some of these salts deposited within the masonry will probably appear on the exterior surface of the masonry as efflorescence, which may be washed off or brushed off by hand. However, not all of these chloride sales will migrate to the exterior surface. Salts remaining within the masonry may eventually cause spalling of the masonry units themselves. Furthermore, the use of hydrochloric acid may also result in the formation of yellow ferrous chloride stains on some types of masonry.

Commercially available acid-based cleaners usually contain varying combinations of hydrofluoric, phosphoric, hydrochloric (muriatic), sufuric, acetic, and oxalic acid. As a final caution, it should be noted that despite the manufacturer's recommendations, commercially available "all purpose" cleaners that contain hydrochloric acid should not be used on limestone.

Generally, the only appropriate application of diluted hydrochloric acid to historic masonry is to remove excess mortar that

may have been splashed over the stone or brick while repointing, to remove whitewash or other lime or cement-based coating, or sometimes to clean concrete.

### Alkaline Cleaners

*limestone, marble, calcareous sandstone, glazed brick, glazed architectural terra cotta, polished marble, polished granite*

Alkaline cleaners should be used on acid-sensitive masonry materials that would be damaged by acidic cleaners: limestone and marble, calcareous sandstone, glazed brick and glazed architectural terra cotta, and polished marble and polished granite.

Alkaline cleaners consist of two major ingredients: 1) a detergent (or surfactant), and 2) some type of alkali, usually potassium hydroxide. Following their application to the pre-wet masonry, alkaline cleaners are rinsed off with water; then the masonry is given a slightly acidic wash (for example, acetic acid) to neutralize the alkaline solution. The final step is to rinse the masonry with water a second time. Both potassium hydroxide and ammonium hydroxide (ammonia) are suitable alkaline cleaners for historic masonry. (Ammonia cleaners are especially effective in removing soil of a slightly greasy nature.) For lighter-colored calcareous masonry, a more uniform final appearance may require the addition of complexing agents (such as EDTA) and organic bleaches, but only under careful professional supervision. The effectiveness of alkaline cleaners, particularly for removing paint, wax coatings, grease and oil stains, may be increased by a hot water rinse (not over 160°F). Alkaline paint removers as well as alkaline cleaners for dirt removal from calcareous stones are used undiluted.

***Cautions and Precautions.*** Sodium hydroxide (caustic soda or lye) generally should not be used on older or historic masonry. It is extremely harsh and can cause efflorescence and subflorescence, and may also cause physical abrasion and loss of small amounts of a brick surface (figure 14). Ammonium bifluoride is another alkaline cleaner that is commonly recommended as an "all-purpose" cleaner, but in general, ammonium bifluoride solutions are also not suitable for use on limestones, marbles, calcareous sandstones, or unglazed brick because of the likelihood of leaving ammonium salts on the surface or within the masonry.

*Figure 14. Although the sodium hydroxide-based test cleaning patch on the right side of this wall of common brick appears to have been successfully cleaned, closer inspection reveals that a minute portion of the brick surface has been dissolved and removed by the cleaner. As a result, considerable brick dust can be seen in the cracks of the pavement beneath the wall.*

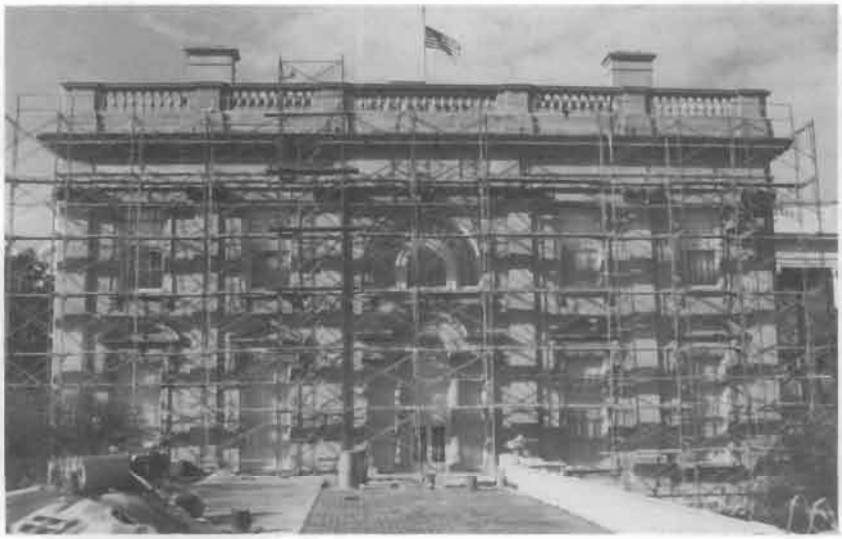
### Surfactants and Detergents

*polished granite, glazed brick, architectural terra cotta*

Surfactants (without acids or alkalies) can be used on polished granite, glazed brick, and architectural terra cotta without risk of etching. Scrubbing with non-metallic brushes (or sometimes even hand-sponging) with a detergent is another effective method of cleaning these smooth surfaces. (However, it may not be possible to remove discoloration caused by dirt that has penetrated a crazed terra cotta glaze.) Non-ionic surfactants can be especially effective in removing oily or greasy dirt.

## Chemical Cleaning to Remove Paint and Other Coatings

Large-scale paint removal from historic masonry buildings can best be accomplished with chemical paint removers, based either on organic solvents or alkaline solutions. Commercial paint removers are



*Figures 15a-15b. If a highly articulated facade is being cleaned it may be necessary to scaffold the building, one elevation at a time. When the monumental task of chemically removing all the paint from the White House was begun, each side was scaffolded in preparation for repainting. Removal of the many layers of paint that had obscured the stone tooling marks for almost a century, without damaging the historic sandstone, required much painstaking hand work. Photograph: National Park Service*

generally formulated to remove most types of paint (except cementitious or lime-based paints such as whitewash) from all types of masonry. But it is always preferable to use an alkaline paint remover on acid-sensitive masonry (figures 15a-15b).

### Alkaline Paint Removers

*limestone, marble, calcareous sandstone, glazed brick, glazed architectural terra cotta, polished marble, polished granite*

One type of paint remover is based on ammonium hydroxide (ammonia), potassium hydroxide, or trisodium phosphate. This alkaline-based paint remover is best used on calcareous and other acid-sensitive masonry, and is particularly useful for removing oil, latex and acrylic paint. (Many paint removers are composed primarily of sodium hydroxide—caustic soda or lye—which, as explained earlier, should not be used on historic masonry because of the likelihood of depositing harmful salts.)

### Organic Solvent Paint Removers

A second type of paint remover is composed of a combination of organic solvents, which almost always includes methylene chloride, and others such as methanol (wood alcohol), acetone, xylene, and toluene. Organic solvent-based cleaners are particularly effective in removing more recently developed coatings, including epoxy and urethane-type coatings. However, methylene chloride-based cleaners may also tend to spread some stains deeper into the masonry, so they must be applied with caution, and of course, only after testing. Both types of paint removers are applied either with a brush or sprayed on the masonry surface. The addition of gels, thickeners and waxes prevents paint removers, which evaporate rapidly, from drying out so that they may remain active on the surface for several hours.

The softened paint is then washed off using a water rinse that may range from as low as 200 psi to possibly as high as 800 psi. Efficiency of the paint removal differs from project to project. Multiple layers of paint may require two or more applications of paint remover, or the use of several types. An intricately carved, rough or damaged masonry surface will also take more time and may not result in a surface completely free of paint. If the paint has penetrated into the masonry, total paint removal may be impossible to achieve without damaging the surface.

### Removing Other Coatings

Traditional lime-based whitewash or color washes that have deteriorated and no longer bond to the substrate, may be removed with hydrochloric (muriatic) acid—which will dissolve the lime *(and also the masonry substrate if it is not applied with caution)*—or sometimes with acetic acid, and hand-scrubbing with non-metallic

brushes. Sometimes prolonged wet poulticing may also be necessary. Twentieth-century cement-based, or textured coatings, may be very difficult to remove without damaging the masonry. They are not likely to be soluble in paint remover, although occasionally hydrochloric acid may be effective, and sometimes they can be removed by hand-scraping. Removal of acrylic water-repellent coatings may usually be accomplished with an alkaline, possibly potasium hydroxide, solution.

***Cautions and Precautions.*** In particular, those paint removers based on organic solvents should be handled with extra caution. Most organic solvents are flammable. Their vapors, easily absorbed through the skin and the lungs, are carcinogenic, and some are irritating to the skin.

It should be noted that the use of heat (applied with a propane torch or similar device) is *never* an acceptable method of paint removal from historic masonry. Not only is heat ineffective, it may actually damage the masonry, and cause softened paint to permeate porous masonry. Furthermore, use of a propane torch also introduces the hazard of fire to historic materials. Finally, the use of high-pressure water in itself is also not an effective or acceptable method of paint removal from historic masonry.

## Poulticing to Remove Stains

The first step in stain removal is to identify the stain; the next step is to try to prevent recurrence of the problem by getting at its source. This source may be integral to the configuration of building materials in a historic structure, and as such, may not be feasible to eliminate. For example, copper flashing will often stain light-colored stone or brick. And the more porous the masonry, the greater the tendency for the masonry to become stained. Thus, while glazed brick and architectural terra cotta are generally resistant to penetrating stains, limestone and marble are considerably more likely to stain because of their porous nature. The fact that acids should not be used on acid-sensitive materials frequently means that, while an acid might indeed be capable of removing a certain stain from brick or a siliceous stone, an alternative, non-acidic cleaner must be substituted when dealing with a calcareous or otherwise acid-sensitive masonry type. There are many premixed poultices commercially available that are based on much the same composition as those described here.

Frequently stains will be removed during a general cleaning of the masonry. But the removal of disfiguring stains, graffiti, and efflorescent salt deposits from masonry is often a complex and challenging undertaking. It is complicated by the fact that, unlike particulate dirt which tends to sit on the surface, stains generally penetrate into and permeate the masonry.

For this reason, poulticing is generally the most effective means of removing stains from historic masonry. Efficient stain removal requires that a cleaning solution (selected according to the type of stain) be kept in contact with the stained area for as long as possible, and that the cleaning solution pull out the staining material without redepositing or spreading it on the masonry itself (figure 16). Poulticing methods meet all these requirements.

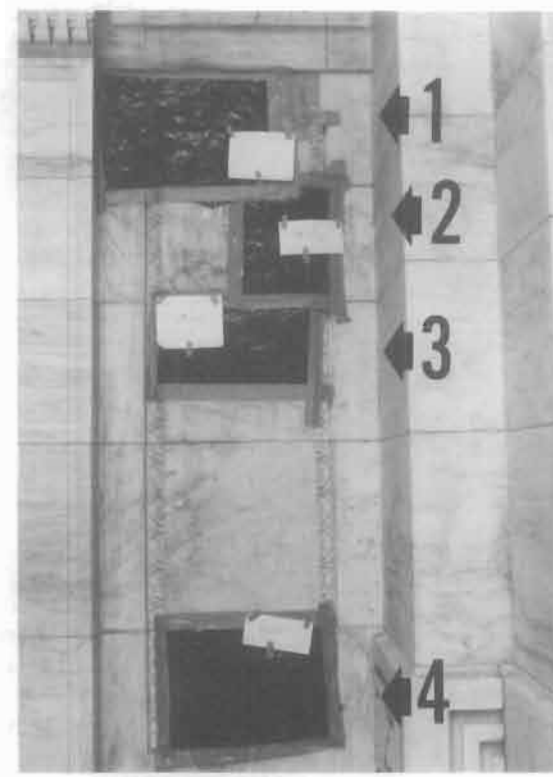



*Figure 16. Four different poultice mixtures were tested to remove metal stains from this marble wall. From top to bottom, they included a commercial poultice, as well as formulations of peroxide and hydrated lime, ammonia and hydrated lime, and sodium citrate and glycerine with hydrated lime. Photograph: The Ehrenkrantz Group*

Simply stated, a poultice is composed of an absorbent material or powder, mixed with a liquid to form a paste or slurry. The absorbent powders or chemically inert fillers used to make up the poultice not only slow the rate of evaporation or reaction, allowing adequate time for the solvent to dissolve the stain, but also provide a vehicle to accept the staining material after it has been pulled from the masonry. Among the powders commonly used for poulticing are clays (such as attapulgite, kaolin and fuller's earth), talc, chalk (whiting), sepiolite (hydrous magnesium silicate), diatomaceous earth (kieselguhr) and methyl cellulose. While absorbent clays and diatomaceous earth are the most efficient, whiting and kaolin are the cheapest. It should be noted that the absorbent material for a poultice does not always have to be powdered, but can consist of shredded acid-free paper or absorbent cotton or cotton pads. (Generally, whiting, or iron-containing clay such as fuller's earth, should not be used as the absorbent ingredient if an acid is used as the solvent; they will react with, and thus, negate the effectiveness of the acid.)

Next, the type of solvent (liquid) is chosen to match the requirements of the stain to be removed. It will either be water for a chemical poultice or an organic solvent for stains that are soluble only in solvents. A heavy or thick poultice may require additional support on vertical surfaces in the form of a non-ferrous, or plastic mesh which can be held against the wall with non-staining fasteners. The poultice will clean more effectively if kept wet throughout the dwell period. It can be covered with plastic to prevent it from drying out too rapidly, and can also be rewetted if it dries too quickly without having removed the stain. If a single poulticing operation is not effective, a second application can be made. After removing and discarding the poultice material, the area should be thoroughly rinsed with clean water to cleanse the masonry of any chemical residue (figure 17a - 17d).

The poultice is applied as follows: a ¼-¾ inch layer of the paste is applied to the masonry surface, and the liquid is absorbed into the masonry to act upon the stain. As the poultice dries out, the liquid is re-absorbed back into it, drawing out the stain. The poultice is allowed to dry completely, and is removed gently by

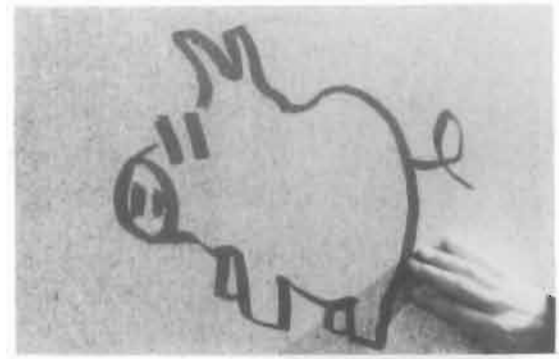


*Figure 17(a). This graffiti was applied with a wide felt-tipped marker to a polished granite wall. To facilitate removal and to prevent the image from penetrating further into the stone, the masonry surface was first wetted with denatured alcohol.*

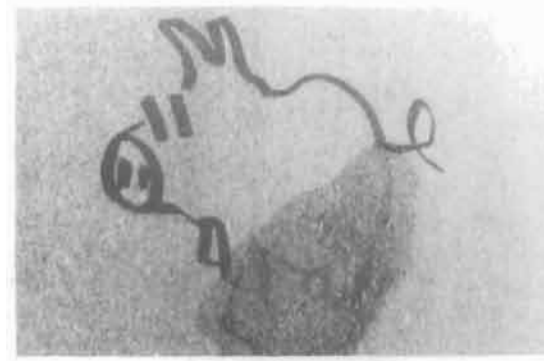


*Figure (b) Most of the image was removed using a rag saturated with a mixture of solvents, including acetone, lacquer thinner and N-methy-2-pyrrolidone.*

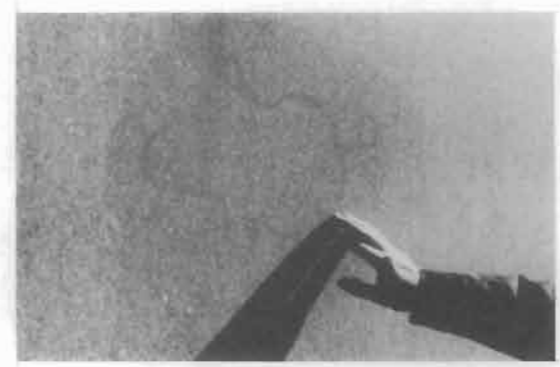


*Figure (c-d) The slight ghost outline remaining was easily removed with the solvent mixture in a poultice composed of attapulgite and Kaolin clays and whiting, and followed by a thorough detergent and water wash. Photographs: Nicholas F. Veloz*

hand with a wooden scraper or non-metallic brush.

### Metallic Stains

In general, metallic stains on siliceous or acid-resistant surfaces can be removed effectively with a weak acid solution. Metallic stains on acid-sensitive masonry should be removed using an alkaline salt of the appropriate acid (for example, ammonium oxalate to remove rust stains). Metal compounds are responsible for a great number of stains on historic masonry structures. Of these, rust stains from *iron* are probably the most common. The orange color is caused by small particles of hydrous iron oxide. Most rust stains are directly related to the corrosion of exterior ironwork such as porch railings and grillwork, or concealed interior support mechanisms such as iron anchors and tie rods. Corrosion is usually initiated by water penetration into the building, primarily via cracks and open mortar joints, and the stains will continue to reappear if these leaks are not repaired. However, some rust stains are due to certain iron-containing minerals, such as pyrite, that may occur naturally in the stone and, as such, cannot be removed.

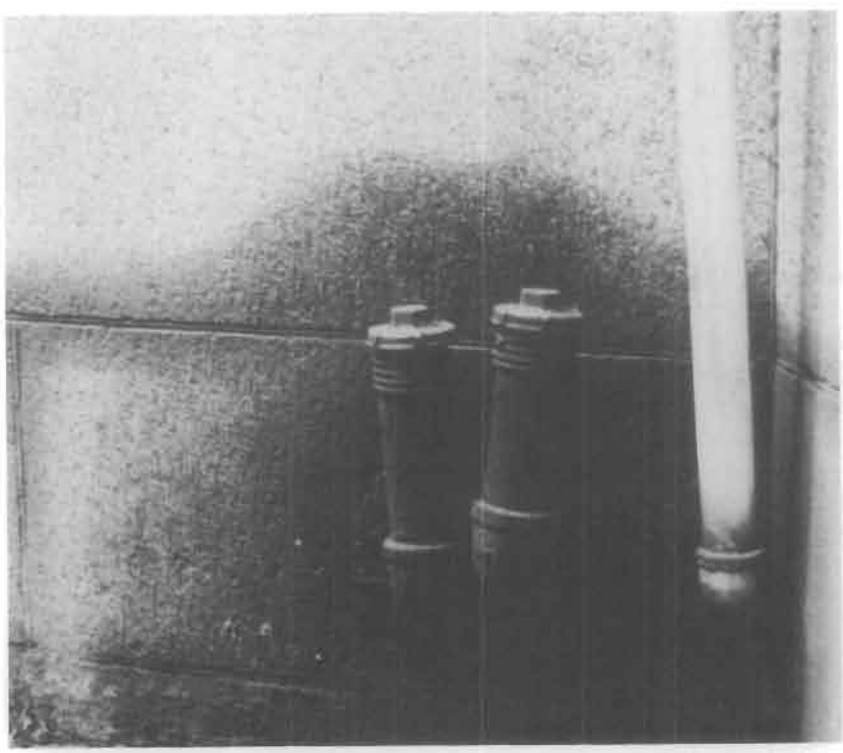


*Figure 18. Removal of this oil stain which has penetrated deep into the granite will necessitate poulticing with an organic solvent.*

Green stains are usually associated with the presence of a number of *copper* compounds. Copper roofing, brass ornaments and bronze hardware and sculpture are among the obvious scources of green staining. Copper and bronze stains are usually not difficult to eliminate successfully. Generally, they are soluble in an ammonia solution (aqueous ammonium hydroxide).

### Industrial Stains

Industrial stains result from contact with such materials as *fuel oil, asphalt* and *tar*. Some superficial (or surface) industrial stains, like smoke and soot and oil, may be removed by gently scrubbing with a scouring powder containing bleach (but not household bleaches which are sodium-based) or water-based household detergents that are acid and alkali-free. However, scouring powders sometimes contain abrasives which may damage delicate masonry surfaces. Ammonia also dissolves some superficial oily stains; thus, a solution of ammonia and water applied in a poultice is useful for removing oil and grease stains from marble. But most procedures for the removal of these oily stains require the use of organic solvents. Because flooding the surface with solvents is both inefficient and costly, brushing with an emulsion of organic solvents such as mineral spirits may be more effective. A water rinse afterward is necessary.

Industrial stains that have penetrated more deeply into the masonry should not be rubbed in, but should always be removed with a poultice (figure 18). An appropriate solvent (or solvent mixture) must be selected. This will probably involve some testing to find a solvent best suited to the type of stain. Among the common organic solvents that may be effective in removing industrial stains are the following: naptha, mineral spirits, chlorinated hydrocarbons (such as methylene chloride and perchloroethylene), ethyl alcohol, acetone, ethyl acetate, amyl acetate, toluene, xylene, and trichlorethylene. (A slight variation of the poultice method consists of thoroughly soaking the stained area with the solvent, and immediately covering it with absorbent powder.)

It may not always be possible to remove all traces of asphaltic stains, but their visual impact will be substantially reduced

by using these methods. Additional washing and scrubbing with detergent or scouring powder following application of the poultice may further reduce staining.

Removal of larger chunks of asphalt or tar accumulations may be facilitated by applying dry ice or spraying with carbon dioxide. The asphalt or tar will be embrittled by the dry ice or carbon dioxide, and after tapping with a small hammer, can usually be removed from the masonry surface by prying it up with a putty knife, (figure 19). This same technique can be use for removing gum, adhesives or other sticky substances, Such techniques, however, should not be used on wet masonry, as they may freeze the moisture in the masonry, and cause cracking or spalling. Organic solvents or bleaches are also effective, sometimes in a poultice, on sticky substances.

*Figure 19. Efficient removal of tar splatters from limestone and sandstone may be facilitated initially by applying dry ice or carbon dioxide, but complete removal will probably require poulticing with an inorganic solvent.*

**Biological Stains**

Heavy growths of *lichens, algae, moss and fungi* should be removed from masonry surfaces. Lichens in particular, and mosses, tend to encourage stone or masonry deterioration, because they produce oxalic acid, and, because like other plant growth, they attract—or are attracted to—moisture, one of the major enemies of masonry. Thus, in most cases, it is best to eliminate all plant, lichen and algae growth on historic masonry.

Lichens and algae can usually be removed with water and a stiff natural bristle brush, after soaking, if necessary (figure 20). Stains caused by plant growth such as mildew (which is a fungus) can sometimes be removed with organic solvents, but are generally best treated with diluted ammonia or bleaches. Hydrogen peroxide can also be effective. Calcium hypochlorite solutions and pastes (the basic of swimming pool chlorine) and Chloramine-T may also be useful in many cases. Chemical removal of the growth itself may sometimes be accomplished with zinc or magnesium fluorosilicate, copper naphthenate, or with a variety of quartenary ammonium salts. Low-to-medium-pressure (100-400 psi) water rinsing can be used to eliminate much of the plant material prior to treatment and stain removal. However, these compounds should be used with caution, as some copper compounds may stain light-colored masonry, and the use of zinc or magnesium fluorosilicate may result in formation of a surface crust on some masonry.

*Figure 20. Plant growth such as lichens growing on a protected side of this limestone and granite parapet wall, can be damaging even to a relatively hard stone like granite because lichens secrete oxalic acid. Lichens can usually be removed, after soaking with water by scrubbing with a stiff natural bristle brush.*

Other growing vines such as ivy and Virginia Creeper should be cut at the roots, and allowed to dry before removal to prevent the disk-tipped tendrils

characteristic of these plants from dislodging parts of the masonry. Once the plants have dried up they can be carefully pulled off; the roots should be killed (ammonium sulfamate may be applied to the roots if necessary, taking care not to get it on the masonry). Any remaining dried plant material on the walls can be removed by scrubbing with a non-metallic brush, and then washed off (figure 21). Except in extreme cases, herbicides should not be used to remove algae, moss or lichens because of the danger of introducing addtional salts or acids into the masonry, as well as the potential for creating environmental problems.

Most of these forms of plant growth on masonry buildings—algae, moss, lichens and fungi—are a direct result of moisture in the masonry and lack of sunshine. Thus, unless the specific conditions change, i.e., the moisture problem is eliminated, or the masonry is given more exposure to the sun, they will recur continually (figure 22). A leaking downspout or gutter can be repaired, a tree or bush too close to the building can be trimmed or pruned to introduce more sunlight, and even lawn sprinklers can be redirected so they do not repeatedly deposit excessive amounts of water on the same area of a building surface (figure 23).

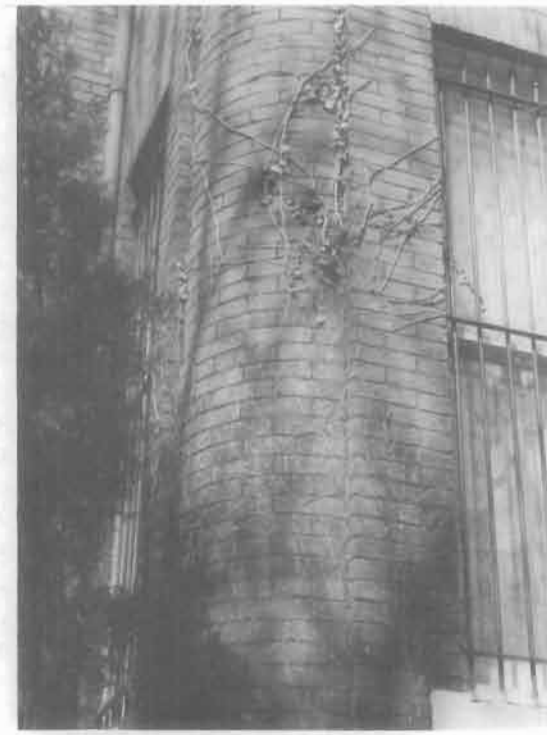


*Figure 21. After the ivy was cut at the roots, it has been allowed to wither and die before being pulled off the wall. Most of the ivy has been removed, but a few tendrils still cling higher on the wall. After these have completely dried and have been pulled off, the remaining dried plant material can then be removed from the brick by scrubbing with water and a bristle brush.*

*Figure 22. The discoloration on this white marble is a green-colored algae growth on a shady side of the building and caused by water dripping from the air-conditioner above it.*

*Figure 23. The moss growing around the downspout and along the base of this stucco building clearly indicates the presence of excess moisture—here due to rising damp as well as a leaky downspout. Photograph: Lee H. Nelson, FAIA*

## Graffiti

As with other types of cleaning problems, it is always preferable to identify the substance used to create the graffiti before selecting what is likely to be the best remover. If there is any possibility of discovering how the graffiti was applied (such as discarded spray paint cans in the immediate area), it is worthwhile to investigate, since the manufacturer of a particular product may be able to provide specific information concerning the ingredients of the paint, and thereby simplify the task of removal. It is also important to be aware that it may be extremely difficult, if not impossible, to completely remove all traces of some types of graffiti. Successful and total removal of graffiti may depend on the type and surface texture of the masonry, as well as the particular substance applied. After its removal, which is essentially a spot cleaning operation, the masonry surface may appear spotty. If too unsightly, cleaning the entire surface or wall may be necessary. Sometimes it may be easier to "redirty" slightly the cleaned area to blend in with the uncleaned wall.

Like most other cleaning projects, successful graffiti removal will probably involve a "trial and error" approach, unless the material used to apply it can be readily identified before cleaning is begun. And, as with any type of cleaning of historic masonry, the gentlest method possible should always be tried first; otherwise, one may run the risk of permanently etching the graffiti into the masonry surface.

Painted graffiti applied from a spray can or by a felt-tipped marker or lipstick may generally be removed from masonry by a commercial paint remover—either a solvent type of remover such as lacquer thinner or acetone, or a methylene chloride-based remover (figure 24). In some instances, poulticing may not be necessary. If the graffiti has not permeated deeply into the masonry, it may be removed by the paint remover or a solution of trisodium phosphate brushed on with a non-metallic brush. After the paint has softened, as much as possible should be scraped off with a wooden scraper. Then the area should be washed again using a detergent and soapy water, and rinsed thoroughly with water.

A variety of commercial solvents are available on the market, which may contain aromatic non-chlorinated solvents such as xylol, toluene with methanol or ketone, or chlorinated hydrocarbon solvents such as methylene chloride. But before trying these solvents which, as noted, are effective but are also very toxic and dangerous to handle, it is always best to try something milder, such as a detergent solution and water combined with hand-scrubbing with a non-metallic brush.

Although many cleaning contractors may advise application of a coating to protect masonry surfaces that are particularly vulnerable to defacement by graffiti, a coating is generally not recommended. Historic masonry may be discolored or damaged more by such coatings, which may inhibit moisture evaporation, than by the graffiti. Furthermore, the coating itself is likely to be removed by subsequent graffiti removals.

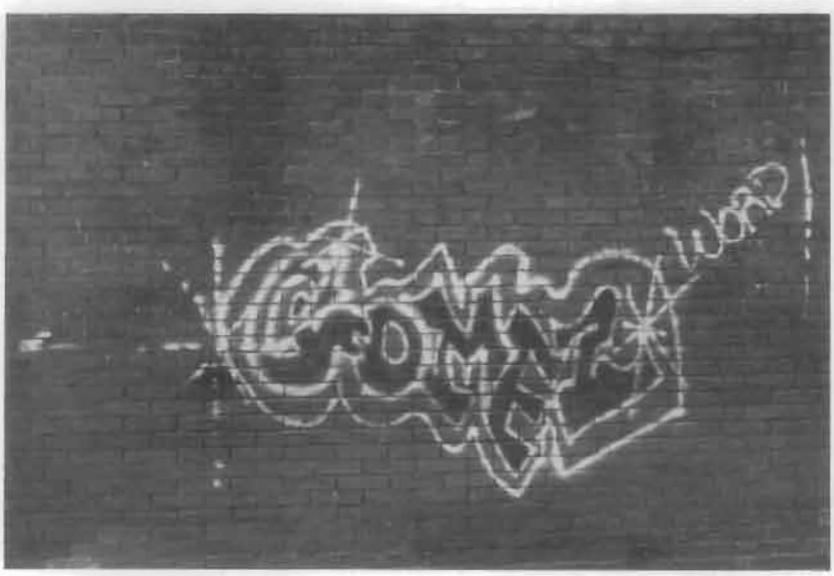


*Figure 24. Spray-painted graffiti on this brick wall can be removed with paint remover, and in this case, probably will not require poulticing.*

## Salt/Efflorescence

Efflorescence is a whitish powder made up of excess salts that have crystalized on the masonry surface. Because efflorescence may have many causes, it is important to identify the source of the problem. For example, although efflorescence is usually a sign of excessive amounts of moisture in the masonry, it may also result from

chemical cleaning or repointing if the masonry is not thoroughly rinsed. It may also come from heavy use of de-icing salts, or rain penetrating masonry through deteriorated mortar joints may result in efflorescent patches on an entire facade. Finally, air pollution often results in the formation of thick sulfate (salt) crusts on the underside of moldings and eaves—areas not regularly washed by rainfall (figure 25).

Efflorescence can usually be brushed or washed off with water since it is formed of water soluble salts. Some efflorescence that results from cleaning may eventually disappear through normal rain washing; however, some chemical residue left from the cleaning process can form damaging insoluble salts. Efflorescence resulting from water penetration into the masonry structure will continue to reappear unless the source of the water entry is removed; thus, the first task is to identify the point of entry and stop the water penetration (figure 26).

*Figure 25. Excess moisture leaching out through the walls has resulted in the formation of white efflorescent salts on the brick and blackish sulfate salts on the limestone water table.*

*Figure 26. Efflorescent salts appearing on many of the brick piers of this turn-of-the-century building may indicate the existence of clogged interior gutters that, because they no longer function have been supplemented by an exterior rain removal system. Photograph: National Park Service*

Sulfate encrustations often may be removed with a heavy wooden scraper. But removal of particularly heavy salt buildup may also require a poultice of one of the following: diatomaceous earth, cotton, crushed dolomite, crushed limestone, or shredded polyester fiber soaked in distilled water. The area of the masonry that displays efflorescence should also be soaked in distilled water before applying the poultice to avoid redistributing the salts back into the masonry.

***Cautions and Precautions.*** Several points need to be made regarding the use of chemicals in poultices. First, copper stains should never be removed from limestone with potassium cyanide or sodium cyanide as is sometimes recommended. Both of these cyanide compounds can be lethal to cleaning personnel. Second, most organic solvents are flammable. Their vapors, easily absorbed through the skin and the lungs, are carcinogenic, and some are irritating to the skin. Third, bleach should never be used in conjunction with ammonia in a poultice; this simple-sounding household combination produces toxic chlorine gas that may cause lung tissue damage or death. Finally, spraying liquid nitrogen or asphalt or tar will make it brittle and thus removable, but it is highly flammable and so dangerous to work with that a user must be specially licensed.

## Other Methods of Stain Removal

While it is usually necessary to employ a poultice to remove most stains on masonry, other, sometimes simpler, procedures may also be effective. If a stain is superficial, it may often be eliminated by applying a chemical remover or solvent with brushes, or by "washing" the solvent over the surface using a low pressure (under 100 psi) spraying apparatus. It may also help to coat the surface with talc

or similar material to help absorb the stain in a sort of simplified poultice. To prevent outward migration of the staining agent, which would increase the size of the stained area, the masonry immediately adjacent to the stain on all sides should be thoroughly prewetted. Following application of the cleaning solution, the masonry must be rinsed off, and the entire procedure repeated, as necessary. Rinsing need not be done with pressure; in fact, it is normally sufficient to gently flood the treated surface for several minutes.

***Cautions and Precautions.*** Mechanical or abrasive procedures such as sandblasting, grinding or chiseling to remove dirt, paint, stains or graffiti are not acceptable methods of cleaning historic masonry. Such abrasive methods may—with varying degrees of success—remove the offending substance from the masonry, but may also damage the masonry by removing or abrading the outer surface layer (figure 27). Very loose or flaking paint or a similar coating on smooth surfaces, such as brick, may sometimes be successsfully removed by careful hand-scraping in preparation for repainting, but the physical irregularities of most rough-cut or carved surfaces make this impractical. Furthermore, abrasive cleaning techniques may also be harmful to the applicator, passersby and public property.

## Cleaning to Remove Bird Droppings

Removal of small amounts of bird droppings may be accomplished as part of a regular cleaning project with cold water washing, possibly supplemented with detergents and chelating agents such as EDTA (ethylene diamine tetra-acetic acid), or on non-acid sensitive masonry with acidic cleaners, where appropriate. Removal may also be facilitated by brushing with a non-metallic brush and scraping with a wood scraper (figure 28).

In some instances where particularly porous types of stone may have been stained by heavy accumulations of droppings that have permeated into the stone over the years, they can be removed by using a combination of the above materials.

***Cautions and Precautions.*** Histoplasmosis and cryptococcosis, both potentially fatal

*Figure 27. Heavily pitted by sandblasting, this window recess provides a vivid contrast to adjacent undamaged brick protected from abrasion by a metal signboard.*

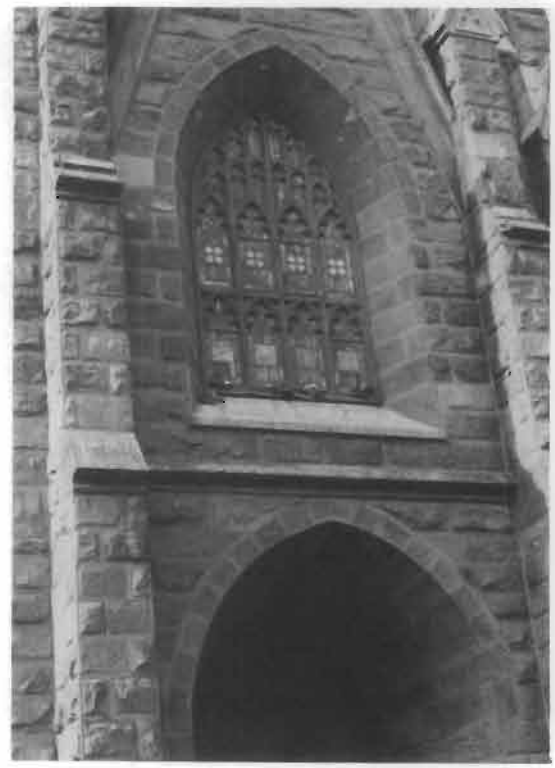


*Figure 28. If water, or water and detergent wash, does not remove the pigeon droppings from this sandstone sill and stringcourse below, it may be necessary to use a dilute acidic cleaner containing hydrofluoric acid, providing the sandstone is not calcareous and thus, acid-sensitive.*

diseases of the lungs and central nervous system, can result from exposure to accumulations of pigeon excrement. Because of this disease potential, it may be better to apply water pressure from a safe distance to remove excessive amounts of droppings and better not to attempt total removal, particularly if droppings are not highly visible or do not appear to be damaging the masonry. Bleach should not be used as a component of any removal process; bird droppings contain ammonia, which forms toxic gases when mixed with some bleaches. When removing bird droppings, cleaning personnel should guard against exposure to the attendant health hazards by wearing protective masks and clothing.

# Part III
# Summary of Guidance

## The "Gentlest Means Possible"

Although masonry may be one of the most durable of historic building materials, it is nonetheless susceptible to damage by improper maintenance or repair techniques and by harsh and abrasive cleaning methods. Thus, cleaning historic masonry is recommended only when necessary to halt deterioration or to remove heavy soiling, and *only* after careful testing. Observing the "gentlest means possible" rule always means beginning with a low-pressure water wash, supplemented, if necessary, with non-ionic detergents and scrubbing with non-metallic brushes. If this very gentle method does not clean the masonry, or if paint or stains must be removed, the next step is to use a chemical cleaning process. Abrasive cleaning methods are damaging and are not suitable cleaning techniques for historic masonry buildings.

# Summary of Cleaning Techniques*

| Substance to be Removed | Acid-Sensitive Masonry<br>**Limestone, Marble, Calcareous Sandstone, Glazed Brick, Architectural Terra Cotta, Polished Granite** | Non-Acid-Sensitive Masonry<br>**Sandstone, Slate, Granite, Unglazed Brick, and Unglazed Terra Cotta, Concrete** |
|---|---|---|
| **Dirt and/or Pollutant Crusts** | Water wash<br>Water + non-ionic detergent<br>Alkaline cleaner<br>(ammonia or potassium hydroxide) | Water wash<br>Water + non-ionic detergent<br>Acidic cleaner<br>(hydrofluoric acid) |
| **Paint**<br>(oil, latex, acrylic coating, vinyl, epoxy, urethane-type coatings) | Alkaline paint remover<br>(ammonia or potassium hydroxide or trisodium phosphate)<br><br>Organic solvent paint remover<br>(methylene chloride) | Alkaline paint remover<br>(ammonia or potassium hydroxide or trisodium phosphate)<br><br>Organic solvent paint remover<br>(methylene chloride) |
| **Whitewash and Cementitious Paints** | Acetic acid *or* very weak solution of hydrochloric acid | Acetic acid<br>Hydrochloric acid |
| **Stains - Iron (Rust)** | *Poultice with:*<br>Sodium citrate in water + glycerine *or*<br>Ammonium oxalate | *Poultice with:*<br>Oxalic acid or orthophosphoric acid + sodium salt of EDTA in water *or*<br>Dilute hydrofluoric acid |
| **Stains - Copper** | *Poultice with:*<br>Ammonium chloride *or*<br>Aluminum hydroxide + ammonia | *Poultice with:*<br>Ammonia ( + EDTA) *or*<br>Dilute hydrofluoric acid |
| **Stains - Industrial**<br>(smoke, soot, grease, oil, tar, asphalt, waxes) | Scouring powder with bleach<br>Water-based household detergent<br>Ammonia<br>Mineral spirits<br>Alkaline cleaner<br>*Poultice with one of the following:*<br>Sodium bicarbonate (baking soda)<br>Naptha<br>Mineral spirits<br>Methylene chloride<br>Perchloroethylene<br>Ethyl alcohol<br>Acetone<br>Ethyl acetate<br>Amyl acetate<br>Toluene<br>Xylene<br>Trichloroethylene<br>Dry ice/carbon dioxide (Tar, Asphalt, Gum) | Scouring powder with bleach<br>Water-based household detergent<br>Ammonia<br>Mineral spirits<br>Alkaline cleaner<br>*Poultice with one of the following:*<br>Sodium bicarbonate (baking soda)<br>Naptha<br>Mineral spirits<br>Methylene chloride<br>Perchloroethylene<br>Ethyl alcohol<br>Acetone<br>Ethyl acetate<br>Amyl acetate<br>Toluene<br>Xylene<br>Trichloroethylene<br>Dry ice/carbon dioxide (Tar, Asphalt, Gum) |
| **Stains - Plant and Fungal**<br>(lichens, algae, moss, fungi) | Dilute ammonia<br>Bleaches<br>Hydrogen peroxide<br>Sodium hypochlorite<br>Chloramine-T | Dilute ammonia<br>Bleaches<br>Hydrogen peroxide<br>Sodium hypochlorite<br>Chloramine-T |
| **Stains - Graffiti**<br>(paint, spray-paint, felt-tipped marker) | Organic solvent or alkaline paint remover<br>Lacquer thinner or acetone<br>Organic solvent (methylene chloride)<br>See also **Paint,** above | Organic solvent paint remover<br>Lacquer thinner or acetone<br>Organic solvent (methylene chloride)<br>See also **Paint,** above |
| **Salt/Efflorescence** | Water wash<br>Water (poultice) | Water wash<br>Water (poultice) |
| **Bird Droppings** | Water wash<br>Water + detergent<br>+ chelating agent such as EDTA | Water wash<br>Water + detergent<br>+ chelating agent such as EDTA<br>Acidic cleaners (hydrofluoric acid) |

*Cleaning techniques are listed in order starting with the "gentlest means possible."

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